Chapter XVII
Manastash Ridge LSR

This document is an individual LSR chapter, a part of the larger LSR/MLSA assessment titled "Late Successional Reserve and Managed Late Successional Area Assessment, Wenatchee National Forest", 1996. This forest-wide document provides an overview and other supporting details that this document is associated with. Sections of this Manastash Ridge LSR chapter references the forest-wide document.

This individual chapter focuses on the Manastash Ridge LSR. The first section "A", provides a more specific description of unique resources or factors associated with this LSR than was presented in the general "forest-wide" chapters. Section "B" begins the analysis portion of this document assessing relationships between this LSR and neighboring LSR/MLSA's. Section "C" continues that analysis focusing on this individual LSR.

The subheadings in "B" and "C" follow the module sequence as shown on the "LSR Analysis Flow Chart" in Chapter VII and in Appendix A. A fire plan is also included at the end of Section "C" to provide more specific detail than that in the fire management plan included in the Chapter VII. Section D includes a table summarizing all of the projects identified from the analysis of each module completed in sections B" and "C".

It is also important to note that the type of activities derived from these modules all strive to restore or maintain late successional habitat and species, as such these modules recommend "ecologically derived" projects. The social module, on the other hand, is designed to review projects that do not incorporate these restoration or maintenance objectives. The social module is designed to provide a "road map" to use when planning begins on a specific project that is derived from some social need such as building a new hiker or motorized trail, expanding a ski area, or widening a powerline right-of-way. Since the social module is not used to identify "ecologically derived" projects, the module is not included in this or any of the other individual LSR/MLSA chapters. The Assessment Team did complete a social module for the Three Creeks ORV Trail project on the Entiat Ranger District to validate the module. This module analysis is included in Appendix 26 of the forest-wide document.

A. General Description of LSR

This LSR is located on the Cle Elum and Naches Ranger Districts.

1. Vegetation

This section describes the current condition of vegetation groups (see Chapter II, Vegetative Landscape) within the Manastash LSR. Data was derived by a combination of aerial photo interpretation (only in the southern portion on the Naches RD) and modeling (see Chapter II, Vegetative Landscape). It should be noted that site specific information regarding vegetation structure and distribution will need to be updated as restoration projects are initiated. The vegetation layer developed for this analysis serves only as a starting point.

Information is provided below regarding each vegetation group. More detailed information can be found in the Little Naches and Mainstem Naches Watershed Assessments.

a) Dry Forest Group and Grassland/Shrubland

The dry forest group is found in the northeastern most portion of the Manastash LSR. Six percent (6,676 acres) of the Manastash LSR consists of the dry forest group. Within this group, 54% (3,638 acres) is mapped as high density and less than 1 percent is mapped as created openings (Appendix 4). Created openings in this group are largely the result of logging on private land.

In a few limited sites, ponderosa pine exists as the sole overstory dominate, but more commonly it is co-dominant with Douglas-fir and in some locations, grand fir or western larch. In the driest associations, shrub understory composition is dominated almost exclusively by *Purshia tridentata* (Naches Mainstem Watershed Assessment 1995). Shrubs such as *Artemisia tridentata, Berberis aquifolium, Arctostaphylos nevadensis,* and *Phlox speciosa* may also occur as subordinate members of these communities. Grasses include *Agropyron spicatum, Calamagrostis rubescens,* and *Carex geyeri.* Forb composition is represented by *Balsamorhiza caryana, Achillea millefolium, Lupinus sulphureus,* and *Lomatium* spp. (Naches Mainstem Watershed Assessment, 1995).

b) Moist Grand Fir Group/Mesic Western Hemlock

Thirty-eight percent (39,692 acres) of the Manastash LSR consists of the moist grand fir/mesic hemlock group. About half (45%) of this forest group is currently layered and/or mature (mid- to late-successional) (Appendix 4). The layered and/or mature forest is located in the eastern portion of the LSR.

Species composition in the overstory consist largely of Douglas fir, grand fir, western larch and western hemlock. At the moist end western white pine was an important component before the introduction of white pine blister rust (Manastash Initial LSR Assessment, see Disturbance section). Moister associations typically include a shrub component typified by species such as *Spirea betulifolia, Rosa gymnocarpium, Clintonia uniflora,* and *Arnica latifolia* (Manastash LSR Initial Assessment).

c) Subalpine Fir Series

The subalpine fir series constitutes 13% (13,952 acres) of the Manastash LSR. About three-quarters (74%, 10,316 acres) of this series is mapped as layered or mature, while 2% (361 acres) is mapped as created openings and 21% (2,885 acres) as single layered stands (Appendix 4). This series is concentrated along Manastash Ridge. Subalpine fir is the most widespread species within the overstory (Wenatchee National Forest, Ecology Plot Database). Common seral dominants include lodgepole pine, Engelmann spruce, and western larch.

d) Wet Forest Group

A large portion of the Manastash LSR consists of the wet forest group (35%, 36,813; Appendix 4). In general, this forest group can be found in the central and northern portion of the LSR. Nearly three-quarters (72%, 26,368 acres) of this forest group consists of layered or mature stands. Created openings are largely the result of past timber harvest and are mostly located in the northwestern portion of the LSR.

The wet forest group within the Manastash LSR is a fairly contiguous. Western hemlock and Pacific silver fir are the most common overstory dominants forming contiguous forest. Mountain hemlock becomes more important at higher elevations on Manastash Ridge. Western larch and Douglas-fir are the primary seral dominants in this forest group, but both lodgepole and western white pine are present, although scattered. Understory shrubs include *Vaccinium membranaceum* and *Pachistima myrsinites* , and low understory includes *Clintonia uniflora, Pyrola secunda, Berberis nervosa,* and *Chimaphila umbellata*.. In the coldest sites, *Vaccinium scoparium* and *Xerophyllum tenax* are common understory dominants.

e) Non-Forest Vegetation

There are approximately 7,371 acres (7% of LSR) of non-forest vegetation within the Manastash LSR. Included in this group are: grassland/shrubland (2,689 acres), bedrock (738 acres), talus (2,307 acres), wet meadows (297 acres), upland meadow (856 acres), brushfield (197 acres), cliff (130 acres), scree (1 acre), water (60 acres), and agricultural/residential/developed lands (37 acres). Since the Cle Elum half of the Manastash LSR was modeled, wet, dry, and upland meadows and brushfields are under-estimated. More information can be found in the Taneum Manastash Watershed Assessment.

f) Noxious Weeds

A portion of the Manastash LSR was surveyed in 1992 for noxious weed species that occur along roadsides (McRae and Harrod unpubl. report). High densities of *Centaurea diffusa* are present along roads particularly along the Rock Creek, Manastash Creek, and Taneum Ridge. Other species include *Chrysanthemum leucanthemum, Hypericum perforatum, Cytisus scoparius, Hypochasis radiata, Cynoglossum officinale, Senecio jacobaea* and *Cirsium canadensis. Linaria dalmatiea* is abundant adjacent to the LSR and has the potential to invade. Surveys for species presence and extent should be completed in order to develop a noxious management plan for this LSR (refer to Harrod 1994).

2. Late Successional Associated Wildlife Species

a) Introduction

In this chapter, information is presented about wildlife species that are associated with the late-successional habitats that are either present or would be managed for in the Manastash Ridge LSR. A total of 80 species have been identified as being associated with these kinds of forest conditions and are present, unknown or suspected to occur within the LSR. The list of these species can be found in Appendix 27.

In addition to consideration for the groups of species associated with the various kinds of late-successional forests, individual species assessments were also conducted. These assessments were completed for all threatened, endangered, sensitive, candidate, management indicator, protection buffer, and survey and manage species. Collectively this group of species is referred to as species of special status. What information is available about the status of these species within the Manastash Ridge LSR is summarized in this chapter. However, relatively little is known about a number of these species.

Inventories or surveys have been conducted for only a few of the wildlife species as shown in Appendix 27. The most extensive of these were for the northern spotted owl, barred owl, and gray wolf. Northern spotted owl inventories have been conducted over 100% of the suitable habitat, barred owl inventories over 75% and gray wolf over 50% of the habitat within the LSR

b) Late Successional Associated Species by Habitat Types

(1) Dry Forests

About 6,676 acres (6%) of the Manastash Ridge LSR is composed of the dry forest vegetation group. Fire climax ponderosa pine forests historically dominated these areas and 49 wildlife species are associated with these forests.

Currently, 3,638 acres (54%)of the dry forest is in a successionally advanced condition. About 2,519 acres (38%) are in a low density condition and could be fire-climax.

Some species that are associated with the late successional or fire-climax conditions of these forests and that have special management status include: tailed frog, larch mountain salamander, northern goshawk, bald eagle, flammulated owl, pileated woodpecker, hairy woodpecker, white-headed woodpecker, black-backed woodpecker, Williamson's sapsucker, northern flicker, chestnut backed chickadee, pygmy nuthatch, elk, long-legged myotis, long-eared myotis, silver haired bat, fringed myotis, western big-eared bat, pallid bat, marten, and fisher.

Historically, only a minor portion of these areas provided the structures that are associated with suitable spotted owl habitat (Thomas et al. 1990, Buchanan et al. 1995). However, fire exclusion has allowed successional advancement for suitable spotted owl habitat to develop in some areas (Agee and Edmunds 1992, Buchanan et al. 1995). These areas are now being used by spotted owls, however the risk of large scale disturbances causing large scale habitat loss is of major concern (Agee and Edmunds 1992, Buchanan et al. 1995, Gaines et al. in press). One spotted owl activity center occurs in the Dry Forests. This comprises 3% of the total known spotted owl activity centers within the Manastash Ridge LSR.

(2) Mesic Sites Within the Dry Forest

The mesic forest group could not be mapped for the Manastash Ridge LSR because of limitations posed by having to model the vegetation. Mesic sites within the dry forests provide important wildlife habitat and add diversity across the landscape. It is suggested that these sites be identified during project level analysis and that the appropriate treatment criteria be applied.

Historically, fire occurred less frequently at these sites (refer to Chapter III) allowing for succession that resulted in more complex forest structure such as a higher canopy closure, multi-layering, snags and down logs. These forests occurred in a variety of successional stages across the landscape. The late-successional conditions of these Mesic Forests provide habitat for about 66 wildlife species. The high potential for future fires presents a concern about the sustainability of these forests.

Wildlife species that are known or suspected to occur in these habitats and are of special management status include: tailed frog, Cascades frog, larch mountain salamander, northern goshawk, bald eagle, northern spotted owl, great gray owl, flammulated owl, pileated woodpecker, downy woodpecker, hairy woodpecker, white-headed woodpecker, black-backed woodpecker, three-toed woodpecker, red-breasted sapsucker, Williamson's sapsucker, northern flicker, little willow flycatcher, olive-sided flycatcher, chestnut-backed chickadee, pygmy nuthatch, elk, long-legged myotis, long-eared myotis, fringed myotis, Yuma myotis, western big-eared bat, silverhaired bat, pallid bat, marten, and fisher.

This forested vegetation group is capable of providing habitat structure that typically composes spotted owl nesting, roosting, foraging and dispersal habitat, while remaining within the historic range of variability.

(3) Moist Grand Fir/Mesic Western Hemlock Groups

The Moist Grand Fir/Mesic Western Hemlock group covers about 39,692 acres (38%) of the LSR. Historically, fire occurred less frequently than in the Dry and Mesic vegetation groups (refer to Chapter III), allowing successional advancement and complex habitat structure such as high crown closure, multi-layering, and many snags and down logs. These conditions provide habitat for a wide array of wildlife species, including 73 species within the Manastash Ridge LSR.

Currently, about 28,943 acres (73%) of the Moist Grand Fir/Mesic Hemlock group in this LSR is in a late-successional condition. In the absence of any major disturbance, it is expected that in 50 years 35,138 acres (89%), and in 100 years 39,415 acres (99%) of this habitat would be in a late-successional condition.

Wildlife species that are known or suspected to occur within the late-successional conditions of this vegetation group and of special status include the northern goshawk, bald eagle, northern spotted owl, great gray owl, flammulated owl, pileated woodpecker, downy woodpecker, hairy woodpecker, white-headed woodpecker, black-backed woodpecker, three-toed woodpecker, red-breasted sapsucker, Williamson's sapsucker, northern flicker, little willow flycatcher, olive-sided flycatcher, red-breasted nuthatch, pygmy nuthatch, tailed frog, spotted frog, Cascade frog, larch mountain salamander, warty jumping slug, blue-gray tail-dropper, papillose tail-dropper, Columbia pebblesnail, long-legged myotis, long-eared myotis, fringed myotis, Yuma myotis, silver-haired bat, western big-eared bat, pallid bat, elk, lynx, marten and fisher.

This vegetation group is capable of providing structures that compose suitable spotted owl nesting, roosting, and foraging habitat while remaining within the range of historic variability. Thirty (97%) of the spotted owl activity centers located within this LSR are located within this vegetation group and the wet forest vegetation group.

(4) Wet Forest Group

The Wet Forest Group covers about 36,813 acres (35%) of the Manastash Ridge LSR. Historically fire occurred relatively infrequently (refer to Chapter III) allowing for succession to result in complex forest structures such as high crown closure, multi-layering, and high numbers of snags and down logs. These conditions provide habitat for about 54 species that are associated with the late-successional conditions of these forests.

Currently, 26,368 acres (72%) are in a late successional condition. Assuming no large scale disturbances, in 50 years 28,591 acres (78%) and in 100 years 35,777 acres (97%) would be in a late-successional condition.

Wildlife species that are are known or suspected to occur within the late-successional conditions of this vegetation group and are of special status include northern goshawk, bald eagle, northern spotted owl, great gray owl, flammulated owl, pileated woodpecker, downy woodpecker, hairy woodpecker, white-headed woodpecker, black-backed woodpecker, three-toed woodpecker, red-breasted sapsucker, Williamson's sapsucker, northern flicker, little willow flycatcher, olive-sided flycatcher, red-breasted nuthatch, pygmy nuthatch, tailed frog, spotted frog, Cascades frog, larch mountain salamander, Warty jumping slug, blue-gray tail-dropper, papillose tail-dropper, Columbia pebblesnail, long-legged myotis, long-eared myotis, fringed myotis, Yuma myotis, silver-haired bat, western big-eared bat, pallid bat, elk, lynx, marten, and fisher.

The Wet Forest Group is capable of providing structure that composes suitable spotted owl nesting, roosting and foraging habitat while remaining within the historic range of variability. Thirty (97%) of the known spotted owl activity centers are located within this vegetation group and the moist grand fir/mesic western hemlock vegetation group.

(5) Subalpine Fir/Subalpine Larch/Whitebark Pine

Subalpine fir covers about 14,030 acres (13%) of the Manastash Ridge LSR. Historically, fire frequency was relatively low but when fires did occur they were of high intensity. The longer fire return interval allowed for successional advancement that resulted in complex habitat structure such as high canopy closure, high numbers of snags and down logs. Landscape pattern was historically highly variable with a mosaic of seral stages providing habitat for a variety of wildlife species. About 41 wildlife species within the LSR are associated with the late-successional conditions of these forests.

Currently, about 10,316 acres (74%) of these forests are in a late-successional condition. In the absence of any large scale disturbances it is expected that in 50 years 13,201 acres (95%), and in 100 years 13,569 acres (97%) would be in a late-successional condition.

Wildlife species that are known or suspected to occur within the late-successional forest in this vegetation group and have special status include the tailed frog, Cascade frog, larch mountain salamander, northern goshawk, bald eagle, northern spotted owl, great gray owl, pileated woodpecker, downy woodpecker, hairy woodpecker, black-backed woodpecker, three-toed woodpecker, Williamson's sapsucker, little willow flycatcher, olive-sided flycatcher, pygmy nuthatch, long-eared myotis, Yuma myotis, lynx, and marten.

Spotted owls occasionally use these forests, however, usually they only provide foraging habitat

c) Species Specific Information

The information presented in this section provides an overview of what is known about the species identified in Appendix 27 as species of special status. Information is provided on a species by species basis whenever it is available.

(1) Endangered Or Threatened Wildlife Species

There are six wildlife species and one Critical Habitat Unit that are federally listed as threatened or endangered and could occur within the Manastash LSR. These include the bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), northern spotted owl (*Strix occidentalis caurina*), grizzly bear, (*Ursus arctos*), gray wolf (*Canis lupus*), marbled murrelet (*Brachyramphus marmoratus*) and designated Critical Habitat for northern spotted owl.

The bald eagle is known to occur within the Manastash Ridge LSR, however, no formal surveys have been conducted. Peregrine falcons are suspected to occur within the LSR and none of their habitat has been surveyed.

The Manastash Ridge LSR is one of the "big three" spotted owl population cluster/source center LSR's. They are designed to act as a source population for spotted owls, so they can disperse into adjacent smaller LSR/MLSA's. These cluster sources must be large enough to hold multiple breeding pairs, and to support juveniles, subadults and "floaters". Spotted owl populations must be capable of acting as sources of surplus owls for the species' metapopulation. Local populations might cease to act as sources if they are too small or if they occupy highly fragmented habitat (Thomas et al 1990, FSEIS App G-7 to 8, 1994). It is crucial for these large LSR's to provide for stable or improving habitat conditions as they are expected to act as sources of surplus owls for the species' recovery, yet allowing more flexibility in smaller LSR's. For these areas to function as source centers, at least 20 pairs of spotted owls are needed.

A total of 33 spotted owl activity centers occur within or near the Manastash Ridge LSR and about all of the habitat has been surveyed. There are 59,140 acres (57%) of suitable nesting/roosting/foraging habitat within the LSR. The Manastash is capable of having up to about 80,600 acres or 77%, in suitable spotted owl habitat. Only about 5% of this habitat is in the dry forest group, which may not be sustainable. The estimated amount of habitat within a 1.8 mile radius of these activity centers is shown in Table 4. Six (18%) of the activity centers are below habitat threshold, nine (27%) are at threshold, and 18 (55%) are at optimum habitat levels.

The WA-14 and WA-34 CHU's overlaps with the Manastash Ridge LSR. It includes portions of the I-90 corridor, an area of concern. This CHU provides essential east-west and north-south breeding habitat connectivity. This CHU also is necessary to insure protection for the essential elements, since some of the area is checkerboard ownership (national forest lands intermixed with private lands). This CHU provides essential breeding habitat connectivity to adjacent CHU's, important for the range wide distribution of the spotted owl.

No class 1 grizzly bear observations have been made within the Manastash Ridge LSR, however class 1 observations have been reported nearby (Almack et al. 1993). Grizzly bears are suspected to occur within the LSR and about 10% of their available habitat has been surveyed. Gray wolves are suspected to occur within the LSR and about 50% of their habitat has been surveyed. In addition, confirmed wolf locations have been made to the north of this area (Gaines et al. 1995).

The Manastash LSR has "far range" marbled murrelet habitat. One marbled murrelet detection has been recorded on the east side of the Crest, on a portion of the Wenatchee National Forest administered by the Mount Baker-Snoqualmie National Forest. The best connection for marbled murrelet are through the Norse Peak Wilderness, with higher quality contiguous habitat. However, there are four lower quality, low elevation passes that might provide nest structure for these marine birds. These include: Green Pass, Naches Pass, Tacoma Pass and Windy Gap. Less than 1 percent of the suitable marbled murrelet habitat has been surveyed in this LSR. Surveys will be conducted 2 years prior to projects within the marbled murrelet habitat zone, and any breeding sites located will have 1/2 mile protection (NWFP C-10).

(2) Sensitive And Candidate Wildlife Species

There are 16 wildlife species that are on the R6 Sensitive Species list or are federal candidate species that could occur within the Manastash Ridge LSR. These include the goshawk (*Accipiter gentilis*), little willow flycatcher (*Empidonax trailii*), olive-sided flycatcher (*Contopus borealis*), tailed *frog (Ascaphus trueii*), spotted frog (*Rana pretiosa*), Cascade frog (*Rana cascadae*), Columbia pebblesnail (*Fluminicola columbiana*), long-legged myotis (*Myotis volans*), long-eared myotis (*Myotis evotis*), fringed myotis (*Myotis thysanoides*), Yuma myotis (*Myotis yumanensis*), Western big-eared bat (*Plecotus townsendii*), lynx (*Lynx canadensis*), bighorn sheep (*Ovis canadensis),* fisher (*Martes pennanti*), and wolverine (*Gulo gulo*).

(a) Northern Spotted Owl

Thirty-three spotted owl activity centers occur within or near the Manastash LSR and nearly 100% of their suitable habitat has been surveyed. There is 68,147 acres (65%) of suitable nesting/roosting/foraging habitat within the LSR. This LSR has "checker-board" ownership with Plum Creek Timber Company, of the 68,147 acres of suitable spotted owl habitat, 22,960 (34%) is on private land. Of the 33 spotted owl activity centers within or near this LSR, 11 are on private land. The Manastash LSR is capable of having 92,577 acres

(includes both federally and privately owned land) or 88%, in suitable spotted owl habitat, most of that is sustainable as the wetter series. There is a concern about maintaining the spotted owl populations over the long term due to the amount of suitable spotted owl habitat and number of activity centers on private lands.

There are 32 pairs of spotted owls in the Manastash LSR (one pair is located just outside the LSR). A summary of the activity centers, land ownership, reproductive status and habitat within a 1.8 mile radius of the activity centers can be found in Attachment A. Currently, 7 (21%) of the activity centers are below threshold level for habitat available within a 1.8 mile radius, 8 (24%) are at the threshold level, and 18 (55%) are at optimum habitat levels. Two sites are just outside the LSR boundary and need to be field verified to determine if they are part of this LSR population, they are SO811 Mathew, and SO804 Jungle. Additionally, there are 6 activity centers which are counted as below threshold, but due to modeling, may be at threshold or above, these are SO311, SO326, SO349, SO362, SO365, and SO379. All these sites need to be monitored for site validity. Further information on individual spotted owl sites can be found in Table 4, "Manastash LSR - Suitable Spotted Owl Habitat 1.8 & 0.7 Mile Radius"; Table 1 , "Spotted Owl Status, Habitat and Nesting/Roosting/Foraging Habitat" and Attachment A.

Table 1, Spotted Owl Status, Habitat and Nesting/Roosting/Foraging Habitat

Spotted Owl Site	Status[1]	Owner-ship[2]	Dry or Wet Owl[3]	Threshold[4]	Critical Habitat Unit	Forest Interior [5]	Suitable NRF (acres) [6]		Dispersal Habitat (acres) [7]
							1.8 Mi.	.7 Mi.	1.8 Mi. R
SO311	PY	FS	Wet	Below Threshold	WA-14		2,967	454	2,266
SO321	PY	FS	Wet	At Threshold	WA-14		3,807	657	1,763
SO326	PY	FS	Wet	Below Threshold	WA-14		2,835	466	2,402
SO327	PY	PVT	Wet	Optimum	WA-14[7]		5,317	827	248
SO332	P	FS	Wet	Optimum	WA-14	Inside	4,732	774	319
SO338	PY	FS	Wet	At Threshold	WA-14	Near	3,712	619	255
SO343	PY	FS	Wet	Optimum	WA-14	Inside	4,493	751	332
SO349	PY	PVT	Wet	Below Threshold	WA-14		3,619	406	2,687
SO351	PY	PVT	Wet	At Threshold	WA-14		3,105	567	1,739
SO353	PY	FS	Dry	Below Threshold	WA-14		1,768	254	1,745
SO357	PY	PVT	Wet	Optimum	WA-14		4,290	768	1,353
SO358	PY	FS	Wet	Optimum	WA-14	Near	4,065	717	655
SO362	PY	FS	Wet	Below Threshold	WA-14	Near	4,038	495	327
SO364	PY	PVT	Wet	At Threshold	WA-14[7]		3,789	506	648
SO365	PY	FS	Wet	Below Threshold	WA-14	Near	3,994	428	1,726
SO368	P	FS	Wet	At Threshold	WA-14		3,122	604	2,578
SO375	PY	PVT	Wet	Optimum	WA-14	Inside	4,610	704	211
SO378	PY	FS	Wet	At Threshold	WA-14		3,598	535	2,108
SO379	PY	FS	Wet	Below Threshold	WA-14	Near	3,294	409	2,181
SO392	P	FS	Wet	Optimum	WA-14	Inside	4,764	881	223
SO804	P	FS	Wet	Optimum	WA-14	Inside	5,396	864	0
SO808	PY	FS	Wet	Optimum	WA-14	Near	5,151	777	13
SO810	P	FS	Wet	Optimum	WA-14	Inside	4,713	731	39
SO811	PY	FS	Wet	Optimum	WA-14	Inside	5,536	916	0
SO818	P	PVT	Wet	Optimum	WA-14[7]	Inside	5,465	899	0
SO826	P	PVT	Wet	At Threshold	WA-34	Near	3,569	606	0
SO829	P	FS	Wet	Optimum	WA-14	Inside	5,398	863	0

Spotted Owl Site	Status[1]	Owner-ship[2]	Dry or Wet Owl[3]	Threshold[4]	Critical Habitat Unit	Forest Interior [5]	Suitable NRF (acres) [6]		Dispersal Habitat (acres) [7]
							1.8 Mi.	.7 Mi.	1.8 Mi. R
SO830	P	FS	Wet	Optimum	WA-14	Inside	5,008	804	0
SO839	PY	FS	Wet	Optimum	WA-14	Near	5,312	818	0
SO845	P	PVT	Wet	Optimum	WA-14	Inside	5,590	980	227
SO885	PY	FS	Wet	Optimum	WA-14	Inside	5,459	918	101
SO894	PY	PVT	Wet	Optimum	WA-14	Near	5,300	807	109

[1] RS = Residential Single; P = Pair; PY = Pair with Young, based on highest occupancy.

[2] FS = Forest Service; PVT = Private Ownership (ownership at activity center).

[3] If the majority of suitable spotted owl habitat in .7 mile circle is dry or mesic, then it is a dry spotted owl. If the majority is wet, then it is a wet spotted owl..

[4] **Below Threshold**: < 2,663 total suitable spotted owl habitat acres in 1.8 mile circle or < 500 total suitable spotted owl habitat acres in 0.7 mile circle.
At Threshold: 2,663-3,994 total suitable spotted owl habitat acres in 1.8 mile circle.
Optimum: > 3,994 total suitable spotted owl habitat acres in 1.8 mile circle.

[5] **Inside** = activity center is at least 600' inside (forest interior) late successional habitat.
Near = activity center is inside late successional habitat near forest interior.

[6]. Dry suitable spotted owl habitat includes vegetation code 12 where size/structure is multistory greater than 9" DBH; mesic includes code 22; and wet includes codes 32, 36, 62, 64, and 42

[7]. Habitat within 1.8 mile circle around activity center. Dry dispersal habitat includes vegetation codes 11, 13, and 52; mesic includes code 21; and wet includes codes 31, 35, 61, and 41

(i) Critical Habitat Unit

The Manastash CHU WA-14 overlaps into 74% of the Manastash LSR (77,410 acres), and should support a cluster of 20+ pairs of spotted owls. The Manastash West CHU WA-34, overlaps a small portion of the LSR, and is contiguous with an LSR on the west side of the Cascade crest. Portions of the I-90 corridor are within this CHU. The I-90 corridor is noted as high potential for inter- and intra- provincial isolation resulting from extremely poor habitat conditions, such as high levels of past harvest. This is an area of concern for spotted owls, and is critical to the long-term maintenance of essential linkage habitat to provide connectivity between the north and south portions of the Western and Eastern Washington Cascades Provinces. This CHU is connected to the westside of the Cascades. It also provides essential breeding habitat connectivity being adjacent to the Norse Peak Wilderness and other CHU's important for the range wide distribution of owl.

(b) Birds

The goshawk is known to occur and surveys have been completed over about 40% of the available habitat. It is suspected that the little willow flycatcher occurs in the Manastash Ridge LSR and the olive-sided flycatcher is known to occur. Surveys have been completed for a little less than 5% of their available habitat.

(c) Amphibians

Surveys for the tailed frog and Cascades frog have been completed over about 20% of the habitat within the Manastash Ridge LSR. The tailed frog, spotted frog and Cascade's frog are all known to occur in the LSR. Surveys for the spotted frog have been completed over about 5% of their habitat and it is unknown if they occur in the LSR.

(d) Mollusks

No surveys for the Columbia pebblesnail have been conducted and it is unknown if they are present.

(e) Mammals

No surveys for any of the bat species have been completed within the LSR. It is suspected that the long-legged myotis, fringed myotis, Yuma myotis and the western big-eared bat, and known that the long-eared bat and big brown bat occurs in the Manastash Ridge LSR.

Surveys for wolverine and fisher have been conducted over about 5% of the available habitat, and surveys for lynx have not been completed. Fisher are known to occur and it is suspected that wolverines and lynx are present. Bighorn sheep are known to occur within the LSR.

d) Management Indicator Species

There are 12 wildlife species that are listed as management indicator species that occur or could occur within the Manastash Ridge LSR. These species include the pileated woodpecker (*Dryocopus pileatus*), downy woodpecker (*Picoides pubescens*), hairy woodpecker (*Picoides villosus*), three-toed woodpecker (*Picoides tridactylus*), red-breasted sapsucker (*Sphyrapicua ruber*), Williamson's sapsucker (*Sphyrapicua thyroideus*), northern flicker (*Colaptes auratus*), ruffed grouse (*Bonasa umbellus*), mule deer (*Odocoileus hemnionus*), elk (*Cervus elephus*), beaver (*Castor canadensis*), and marten (*Martes americana*).

(1) Primary Cavity Excavators

Surveys for the pileated woodpecker, downy woodpecker, hairy woodpecker have been completed on about 5% of the LSR. These species are known to occur within the Manastash Ridge LSR. Surveys for the three-toed woodpecker, red-breasted sapsucker, Williamson's sapsucker, and northern flicker have been completed on less than 5% of the LSR. These species are known to occur.

(2) Ruffed Grouse and Beaver

Surveys for the ruffed grouse have been completed on less than 5% of the LSR. No surveys for beavers have been completed. Ruffed grouse are suspected to occur and beaver are known to occur in this LSR.

(3) Mule Deer, Elk

No formal surveys for mule deer and elk have occurred within the LSR. Both species are known to occur within the LSR.

(4) Marten

Marten are known to occur in the LSR and about 10% of their available habitat has been surveyed.

e) Survey And Manage, Protection Buffer Species

There are eight species that do or could occur within the Manastash Ridge LSR and are identified as survey and manage, or protection buffer species. These include the great gray owl (*Strix nebulosa*), flammulated owl (*Otis flammeolus*), White-headed woodpecker (*Picoides albolarvatus*), black-backed woodpecker (*Picoides arcticus*), pygmy nuthatch (*Sitta pygmaea*), warty jumping slug (*Hemphillia glandulosa*), blue-gray tail-dropper (*Prophysaon coeruleum*), and papillose tail-dropper (*Prophysaon dubium*).

(1) Birds

The great gray owl is suspected to occur within the Manastash Ridge LSR and no surveys have been completed. No surveys have been completed for the flammulated owl. Less than 5% of the habitat for the white-headed woodpecker, black-backed woodpecker, and pygmy nuthatch has been surveyed. The flammulated owl, white-headed woodpecker, three toed woodpecker, and black-backed woodpecker are known to occur in the Manastash Ridge LSR. The pygmy nuthatch is suspected to occur.

(2) Mollusks

It is unknown if the warty jumping slug and blue-gray tail-dropper occur within the Manastash Ridge LSR and no surveys have been completed. The papillose tail-dropper is known to occur in the LSR and surveys have been completed on less than 5% of their habitat.

(3) Amphibians

No surveys of the larch mountain salamander or the Van Dyke's salamander have been conducted within the LSR and it is unknown if they occur here.

3. Aquatic

The land within the Manastash LSR contains portions of 12 fish production units (FPU's). These FPU's are Big, Little, and Lower Yakima, North Fork Taneum, South Fork Taneum, Taneum, Manastash, Quartz, Matthew-Pileup, Bear Creek, Mainstem Little Naches, North Fork Little Naches. In the Manastash LSR an estimated 14,513 acres (14%) of 104,661 acres are estimated to be within the Riparian Reserve. The average annual precipitation in the Manastash LSR ranges between 25 and 100 inches. This region is in a snow dominated precipitation zone.

The "Land Type Associations" within the LSR show some variety. There are four main Land type associations, they are described as:

- High sediment response and poor hydraulic regulation,
- Poorly regulated hydrologic response,
- Well regulated hydrologic and high sediment response, and
- High moisture stress.

This LSR contains acres along both sides of Manastash Ridge; cooler, moister north facing and hotter, drier south facing areas.

The Naches and Little Naches Rivers, have been designated as key watersheds. Some of the streams that drain from the Manastash LSR include North Fork Little Naches, Mainstem Little Naches, Middle Fork Little Naches, Fawn Creek, County Creek, Blowout Creek, Bear Creek, Cub Creek, Matthew Creek, Pileup Creek, Jungle Creek, Quartz Creek, South Quartz Creek, Manastash Creek, Case Knife Creek, South Fork Taneum Creek, North Fork Taneum Creek, Taneum Creek, Little Creek, Big Creek, and Butte Creek.

A large portion of the land area delineated as the Manastash LSR has a checker board pattern of private and federal ownership. This condition is expected to present challenges to management of aquatic resources.

The Little Naches Pilot Watershed Assessment (LNPWA) and the Taneum and Manastash Watershed Assessment (TMWA) were completed in 1995. These watershed assessments cover all but the Big Creek and Little Creek FPU's on the Cle Elum Ranger District. The watershed assessments identify potential projects to move the aquatic resources toward desired future condition.

Currently, because of multiple barrier problems in the Manastash and Taneum drainages, these Creeks are essentially cut off from use for anadromous fish species. The Little Naches side is in better condition and currently receives returning adult anadromous fish. Other primary factors contributing to the decline of anadromous salmonid stocks include degradation and loss of freshwater habitats, timing and over exploitation in commercial and recreational fisheries, migratory impediments such as dams and loss of genetic integrity due to the effects of hatchery practices and introduction of non-native stocks. Fish habitat condition is rated using three factors for the Taneum and Manastash drainages on pages 70-71 of the TMWA. The factors are: spawning habitat, winter rearing habitat and summer rearing habitat. LNPWA evaluates aquatic habitat for fish and other aquatic species in pages 8 - 13.

4. Human Uses

a) Overview

The Manastash Ridge LSR is located on the Cle Elum and Naches Ranger Districts. Much of the northern border coincides with the National Forest Boundary adjoining lands in other, non-federal ownership. This

LSR includes a substantial acreage, many alternate sections, of privately owned lands. Much of this privately owned land is managed for wood fiber production.

b) Prehistoric and Historic Summary

Although little survey work has been completed, many American Indian sites have been discovered where surveys have been conducted. These surveyed areas have yielded the highest density of American Indian sites on the forest, indicating the area was very heavily used. It appears this area was not only used as a major east/west travel route over the Cascade Range, due to it's low elevation through the Cascades range, but this LSR also served as hunting and food gathering grounds for American Indian groups. American Indians have continued their traditional uses into the present.

There are very few historic resources in this LSR. These resources includes the "Taneum Shelter", a Civilian Conservation Corps structure, evidence of mining activity that began in the 1890's, and the Naches Trail, a wagon road constructed in the mid 1800's, later used for stock drives and now a popular ORV route. The Naches Trail is eligible for listing on the National Register.

This LSR was grazed very heavily by sheep on the Cle Elum Ranger District portion at the turn of the century.

c) Recreation

(1) Campgrounds

There are two campgrounds located within the LSR, both on the Cle Elum Ranger District. Ice Water Creek Campground, with 17 units, was constructed primarily for use by off road vehicle (ORV) recreationists using the many nearby ORV trails. The second campground is Quartz Mountain Campground which is quite small with only three units. This high elevation campground receives moderate to high use during the summer use season by families, ORV recreationists, and equestrians.

(2) Dispersed Camping

While many of the ORV recreationists stay overnight in the area while using the trails, there are few designated campgrounds within the LSR. Many trail riders use campgrounds outside the LSR however a large number of users camp at dispersed sites (undeveloped campsites) within the LSR. One of the more popular dispersed campsites is at "Taneum Junction" where the North Fork and South Fork Taneum Creeks join. The Cle Elum Ranger District has installed a toilet at this location to lessen sanitation problems. Almost all of the dispersed campsites on the Naches Ranger District are located along the Little Naches River. Some of these dispersed sites, particularly the ones located within Riparian Reserves, result in site degradation problems such as loss of soil, soil compaction, and loss of vegetation.

(3) Trails

There are nearly 200 miles of trails within this LSR. Only a small portion of these are non-motorized and the remainder are motorized. Many of these motorized trails are single track, used by motorcycles and mountain bikes . There are only a few miles of trail that provide 4 X 4 opportunities for narrow clearance jeeps or "quads". This ORV trail system is very popular with recreationists, offering a lengthy and diverse riding opportunities. The trail system receives very heavy use, many of the users from west of the Cascades. There are only a few instances where users have built there own trails without Forest Service approval. Some of these trails, constructed through sensitive areas have resulted in resource problems.

(4) Winter Use

During winter months this LSR is popular for the snowmobiling opportunities it offers. A number of miles of forest roads are groomed on both districts to meet the needs of these recreationists, this system is very heavily used. Snowmobile use also occurs on many of the other ungroomed forest roads in the LSR. Many of the snowmobilers on the Cle Elum Ranger District come from west of the Cascades due to it's easy access through the pass while the Naches Ranger District has more use from east-side residents.

(5) Other Recreation

Hunting is a very popular activity in the fall. The Naches and Cle Elum Ranger Districts have implemented the "green dot" system where vehicles may only use roads marked with the green dot from October through December. Some fishing also occurs in major streams such as the North Fork Little Naches River. Other activities include mushroom gathering, Christmas tree cutting and bear grass collecting.

d) Mining

There are a very limited number of very small scale prospecting activities occurring. There are no large scale mining efforts underway.

e) Social and Economic Considerations:

The private land located within this LSR provides many jobs and other economic benefits from production of wood fiber.

The summer and winter recreationists contribute to the local economy through their purchases of food, gas, lodging and other tourism-based support services.

B. Analysis Between the LSR

1. Sustainability

The sustainability of LSR's/MLSA's across the forest is displayed in Table 19 of the Wenatchee National Forest LSR Assessment. The Manastash LSR falls in the lower 1/2 of all LSR's/MLSA's in terms of the amount of at risk vegetation which puts it in the upper 1/2 in terms of overall sustainability. The Manastash has a moderate amount of at risk vegetation, however, due to its larger size the percentage related to the whole is small. An important consideration in terms of sustainability is the relationship of the Manastash LSR compared to its' neighboring LSR's/MLSA's. Two LSR's, (Swauk and Teanaway) and 2 MLSA's (Crow and Milk Creek) are, for the purposes of this analysis, considered to be neighbors. The following table shows the acres at risk and the ignition risk determined in the forest-wide sustainability analysis for the Manastash and its four neighboring LSR's/MLSA's.

Table 2, Sustainability for the Manastash LSR (Acreage and Percent at Risk)

	LSR/MLSA at Risk		LS Forest at Risk		
LSR/MLSA	**Acres**	**Pct.**	**Acres**	**Pct.**	**Ignition Risk**
Manastash	38,858	37%	33,684	49%	Moderate
Swauk	59,488	55%	55,996	91%	High
Milk Creek	11,432	73%	8,513	100%	Moderate
Teanaway	6,840	20%	6,340	35%	Moderate
Crow	412	3%	412	4%	Moderate

The factor driving this analysis, looking at sustainability issues between LSR's/MLSA's, is the amount and location of at risk vegetation between the Manastash and its four neighbors. In other words, linkages in at risk vegetation that would facilitate the spread of fire from one LSR/MLSA to the other or at risk vegetation outside of the LSR that would cause fire to spread into the LSR. Review of maps of at risk vegetation reveals that there is no at risk vegetation between the Manastash and either the Swauk or Teanaway LSR's as much private residential and agricultural land divides them in the I-90 corridor. Approximately two miles divide the Manastash LSR from the Crow MLSA, however, most of the vegetation in this area is in the moist grand fir and wet forest groups and not at risk to catastrophic disturbance. The Manastash and Milk Creek MLSA are adjacent to one another. Both of these areas do have at risk vegetation, however, in the areas where they are

adjacent the predominant vegetation is moist grand fir. This would be a low priority for any treatment designed to lower the threat of catastrophic disturbance.

The most significant risk of disturbances is from disturbances originating outside of the LSR spreading into the LSR. This situation occurs in the lower Manastash drainage. In this area there is a significant amount of dense, successionally advanced forest that could facilitate the spread of fire into the Manastash LSR.

a) Implications

1. Reduce stand density in dense, dry, successionally advanced vegetation types (types 12 and 22) where they exist outside of the LSR in the lower Manastash drainage.

   Potential Projects - Commercial Thinning

2. Improve and maintain the existing fuel break between the Manastash and Milk Creek MLSA.

   Potential Projects - Plant or encourage growth of less flammable deciduous vegetation within the fuel break. Remove down fuels from within the fuel break.

2. Forest-Wide Northern Spotted Owl

The following is the discussion and results of the Forest-wide Spotted Owl Module for the Manastash LSR. See Appendix 1 for more information about the module process for this and other modules.

The Manastash LSR is one of the "big three" LSR's (the others being the Chiwawa and Swauk LSR's), which is important as sources for spotted owl distribution throughout the North Cascades province. The Manastash LSR is located just south of the I-90 corridor, and is in a position to help ensure demographic linkage across the I-90 area of concern by improving population cluster distribution. This LSR provides essential breeding habitat connectivity between the westside Mount Baker-Snoqualmie National Forest LSR's and the Wenatchee National Forest LSR's to the east. The Manastash LSR is important for range-wide distribution of owl habitat as it provides habitat and population distribution on the eastern fringe of the range, and improves linkage with the Western Cascades Province. Special management considerations are important to sustain spotted owl populations, due to the checker-board ownership of private and public lands within this LSR.

The Manastash LSR has high road densities in some of the subwatersheds. Throughout the LSR there is very little security habitat. Located along the roaded areas are past harvests and potential future harvests on private lands. An analysis of private land within the LSR and within individual spotted owl home ranges in the LSR determined that the number of spotted owl pairs that can be sustained above threshold with National Forest system lands only, drops from 26 to 11 pairs. There may be a need to coordinate spotted owl activity center and habitat management or to acquire private land in key spotted owl areas to sustain the population within the LSR, and provide genetic interchange and dispersal opportunities outside the LSR (See Table 11, "Spotted Owl Home Range Management Proposals to Mainain LSR by Priority".

This LSR provides essential breeding habitat connectivity with the Norse Peak Wilderness (NPW), the Crow MLSA, Bumping LSR, and Milk Creek MLSA to the South and the Swauk and Teanaway LSR's to the north. The Unmapped LSR's to the north of this LSR are critical to provide distribution and connectivity for this species.

There is 68,147 acres (65%) of nesting, roosting and foraging habitat for spotted owls in this LSR, this is the highest amount of suitable spotted owl habitat on any of the Forest LSR/MLSA's. It also has the highest amount of potential Nesting/Roosting/Foraging (N/R/F) habitat (92,577acres), most of this is in the moist/wet series and is sustainable habitat.

For these large LSR's to function as source populations, at least 20 pairs of owls should be the management goal (see Table3 "Spotted Owl Pair Goals for 'Big 3' LSR's" below). Currently there are 33 spotted owl activity centers within the Manastash LSR. Early historical reports of spotted owls show they have been part of these ecosystems at least since 1930 in the Cle Elum area (Condor 1946). The current 33 activity centers include 32 spotted owl pairs. However, due to the high amount of private land in the LSR, 22 activity centers may not be

sustained, bringing the owl pair total to 11 pair sites. (See Table 1: "Manastash LSR Spotted Owl Status, Habitat and N/R/F" and suitable spotted owl habitat and activity center map.).

Table 3, Spotted Owl Pair Goals for "Big 3" LSR's with CHU's

Source Center LSR	S.Owl Pair Highest Status as of 1995 Season	S.Owl Pairs - 1994, FSEIS Appendix G, Table G-3	Number of Owl Pairs LSR Should Support, as per CHU discussion.	Number of Owl Pairs Sustainable, Without Private Land
Chiwawa RW 135	16 Pairs + 3 Res Singles	11 Pairs + 1 Res Single	21+ Pairs	-
Swauk RW 129	22 Pr + 2 RS	15 Pr + 1 RS	20+ Pr	-
Manastash RW 125	31 Pr + 2 RS	13 Pr	20+ Pr	11 Pairs above threshold

Table 4, Manastash LSR - Suitable Spotted Owl Habitat 1.8 & 0.7 Mile Radius

Spotted Owl Site	Suitable Spotted Owl Habitat[1]												Restoration Oppor-tunities[3]
	1.8 mile Circle Around Activity Center				*0.7 mile Circle Around Activity Center*				*.33 mile Circle Around Activity Center[2]*				
	Dry	Mesic	Wet	**Total**	Dry	Mesic	Wet	**Total**	Dry	Mesic	Wet	**Total**	
SO311	908	0	2,060	**2,967**	216	0	238	**454**	47	0	22	**70**	M,P,A,C
SO321	0	0	3,807	**3,807**	0	0	657	**657**	0	0	107	**107**	M,A
SO326	830	0	2,005	**2,835**	75	0	390	**466**	21	0	117	**138**	M,P,C,A
SO327	0	0	5,317	**5,317**	0	0	827	**827**	0	0	211	**211**	M,A,C
SO332	0	0	4,732	**4,732**	0	0	774	**774**	0	0	202	**202**	M,A,C
SO338	0	0	3,712	**3,712**	0	0	619	**619**	0	0	164	**164**	M,C,A
SO343	0	0	4,493	**4,493**	0	0	751	**751**	0	0	215	**215**	M,C,A
SO349	125	0	3,494	**3,619**	0	0	406	**406**	0	0	86	**86**	M,P,A,C
SO351	462	0	2,643	**3,105**	183	0	383	**567**	63	0	109	**172**	M,P,A,C
SO353	578	16	1,174	**1,768**	155	0	99	**254**	40	0	6	**46**	M,P,A,C
SO357	0	0	4,290	**4,290**	0	0	768	**768**	0	0	146	**146**	M,A,C
SO358	0	0	4,065	**4,065**	0	0	717	**717**	0	0	173	**173**	M,A,C
SO362	0	0	4,038	**4,038**	0	0	495	**495**	0	0	95	**95**	M,A,C
SO364	0	243	3,545	**3,789**	0	2	504	**506**	0	0	87	**87**	M,A,C
SO365	231	0	3,764	**3,994**	57	0	371	**428**	1	0	106	**107**	M,P,A,C
SO368	638	0	2,484	**3,122**	136	0	467	**604**	43	0	101	**144**	M,P,A,C
SO375	0	0	4,610	**4,610**	0	0	704	**704**	0	0	214	**214**	M,C
SO378	457	0	3,141	**3,598**	82	0	453	**535**	54	0	71	**125**	M,P,A
SO379	572	0	2,722	**3,294**	74	0	335	**409**	0	0	113	**113**	M,P,A,C
SO392	0	0	4,764	**4,764**	0	0	881	**881**	0	0	202	**202**	M,A,C
SO804	0	0	5,396	**5,396**	0	0	864	**864**	0	0	218	**218**	M
SO808	0	0	5,151	**5,151**	0	0	777	**777**	0	0	165	**165**	M
SO810	8	0	4,705	**4,713**	0	0	731	**731**	0	0	182	**182**	M
SO811	0	0	5,536	**5,536**	0	0	916	**916**	0	0	215	**215**	M
SO818	0	0	5,465	**5,465**	0	0	899	**899**	0	0	216	**216**	M,C
SO826	0	0	3,569	**3,569**	0	0	606	**606**	0	0	159	**159**	M,C
SO829	0	0	5,398	**5,398**	0	0	863	**863**	0	0	202	**202**	M
SO830	0	0	5,008	**5,008**	0	0	804	**804**	0	0	197	**197**	M

Spotted Owl Site	Suitable Spotted Owl Habitat[1]												Restoration Opportunities[3]
	1.8 mile Circle Around Activity Center				*0.7 mile Circle Around Activity Center*				*.33 mile Circle Around Activity Center[2]*				
	Dry	Mesic	Wet	**Total**	Dry	Mesic	Wet	**Total**	Dry	Mesic	Wet	**Total**	
SO839	0	0	5,312	**5,312**	0	0	818	**818**	0	0	169	**169**	M
SO845	0	0	5,590	**5,590**	0	0	980	**980**	0	0	216	**216**	M,A,C
SO885	0	0	5,459	**5,459**	0	0	918	**918**	0	0	217	**217**	M
SO894	0	0	5,300	**5,300**	0	0	807	**807**	0	0	195	**195**	M,A,C

[1] Dry suitable spotted owl habitat includes vegetation code 12 where size/structure is multistory greater than 9" DBH; mesic includes code 22; and wet includes codes 32, 36, 62, 64, and 42

[2] A larger circle will be needed if there is less than 100 acres of suitable habitat.

[3] **M** = Monitor Habitat & Site; **P** = Protect Habitat From Risk; **A** = Accelerate Habitat Towards Nesting, Roosting, Foraging; **C** = Coordinate Habitat and Site Management, or Acquire Habitat

The Manastash LSR has 34% spotted owl habitat in "checker-board" ownership, with 11 spotted owl activity centers located on private land. The Plum Creek Timber Company has a Habitat Conservation Plan (HCP, DEIS 11/95, FEIS 3/96), which prioritizes spotted owl activity centers and home ranges throughout the Company land holdings. There will be deferral of habitat reduction on 2600 acres, over 30 sites throughout the landholdings, of which the Taneum/Manastash area is included. Deferrals and Foraging/Dispersal corridors are upon the highest reproductive sites, high density "cluster" sites, habitat that provides connectivity (especially within DCA's and I-90 corridor). Land exchanges or purchases may be considered (HCP pg. 376-380), to provide benefits to LSR's, better than the current conditions, especially in intermingled ownership (NWFP C-17).

Connectivity is essential within spotted owl home ranges, between home ranges, between LSR's/MLSA's and throughout the provinces and the range of the northern spotted owl. The ability of spotted owls to disperse to adjacent LSR/MLSA's is of particular importance as this LSR is intended to act as a source for these other areas.

Spotted owl dispersal habitat is necessary to provide immigration and between the network sites across the range. Wilderness areas have been integrated with the LSR network to provide late successional forests. Specific to spotted owls, wilderness protects populations and nesting/roosting/foraging habitat (ROD pg. 19, NWFP App 3-4 pg. 240, 1994). The Manastash adjoins the Norse Peak Wilderness on the west/southwest, which provides long term connectivity. Though the NPW is naturally fragmented by high elevation meadows and, the forested component around those high points provides connectivity to other LSR's, especially to the west side of the Cascades.

The nearest LSR/MLSA's were evaluated to determine their potential for dispersal to occur (Table 6, "Dispersal Indices for Low, Moderate, and High Mobility Species for the Manastash LSR."). This analysis showed that spotted owls could likely disperse to the Milk Creek and Crow MLSA's to the south, Bumping LSR to the south, Westside LSR to the west. Some dispersal difficulty is expected to the Teanaway and Swauk LSR's to the north.

Habitat providing dispersal/connectivity corridors between LSR's (outside LSR/MLSA's) include: :, Yellow Hill to Davis Creek to Domerie Creek; Cabin Creek to Coles Creek to North Ridge; Peoh Point area, Milk Creek to Devil's Slide; South Fork Crow Creek; Willow Springs to Bumping; and Naches River (see Forest Interior map).

a) Restoration Opportunities And Potential Projects

1. Meet goals of LSR for 21 pairs of spotted owls.
2. Aggressive protection of LSR from outside LSR on Matrix lands, in South Fork Manastash Creek, Litte Naches and lower Taneum Creek..
3. Monitor/maintain connectivity outside the LSR particularly along the I-90 corridor.

3. Connectivity (Plant & Wildlife)

a) Plant Connectivity

Connectivity can be addressed at several spatial scales when assessing an individual LSR. Connectivity of the LSR/MLSA network on the Wenatchee National Forest has been addressed above in the "Function of the LSR/MLSA Network" section of the "Late Successional Reserve and Managed Late Successional Area Assessment, Wenatchee National Forest". Connectivity specific to the Manastash LSR for vascular plants is analyzed from two perspectives here. Refer to the forest overview discussions for connectivity description for lichens, bryophytes, and fungi.

First, connectivity relative to the Manastash LSR can be viewed from how well habitat is connected to surrounding LSR's or MLSA's. Species associated with the dry forest vegetation group are dependent on vegetation between the Manastash LSR and the Milk and Crow MLSA's for connectivity for all dispersal classes. There is no connectivity between the Manastash and the Swauk and Teanaway LSR's for any dispersal class.

Relative to species associated with the moist grand fir/mesic hemlock vegetation group, connectivity is dependent on vegetation outside of the LSR for all dispersal classes between the Manastash and the Milk and Crow MLSA's. Dispersal classes 2 and 3 are dependent on vegetation between the Manastash, Swauk and Teanaway LSR's. There is no connectivity for species with dispersal class 1 between the Manastash and the Swauk and Teanaway.

There is no connectivity in the subalpine fir series for any dispersal class between the Manastash LSR and the Swauk and Teanaway LSR's and the Crow MLSA. The subalpine fir series is not present in the Milk MLSA.

Species associated with the wet forest group in the Manastash LSR are connected to the Teanaway LSR and the Milk and Crow MLSA's for all dispersal classes, except for dispersal class 1 with the Milk MLSA. The wet forest group is absent from the Swauk LSR.

Whitebark pine as a series is absent from the Manastash LSR but individuals are scattered throughout the LSR.

No projects were identified to improve connectivity of habitat's between LSR's or MLSA's. Disconnectivity identified in this analysis results from inherent breaks in the vegetative landscape. Managing forest vegetation within the Snoqualmie Pass AMA (Adaptive Management Area) will be important to maintain connectivity for those species associated with the moist grand fir/mesic hemlock group.

(1) Manastash Vascular Plant Connectivity

The following table presents the results of the connectivity analysis applied to the Manastash LSR. Comparisons are made between the Manastash and the four neighboring LSR/MLSA's in terms of plant species being able to disperse from one LSR to the other. Determinations are made for each vegetation gorup common to the LSR's for each of 3 dispersal classes.

Table 5, Manastash Vascular Plant Connectivity

	Vegetation Group														
LSR/MLSA	**Dry/Mesic**			**Moist GF**			**Subalpine**			**Wet**			**Whitebark**		
Dispersal Class	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
Swauk	N	N	N	N	D	D	N	N	N	A	A	A	A	A	A

	Vegetation Group														
LSR/MLSA	**Dry/Mesic**			**Moist GF**			**Subalpine**			**Wet**			**Whitebark**		
Dispersal Class	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
Teanaway	N	N	N	N	D	D	N	N	N	Y	Y	Y	A	A	A
DM-9 (Milk)	D	D	D	D	D	D	A	A	A	N	Y	Y	A	A	A
DM-14 (Crow)	D	D	D	D	D	D	N	N	N	Y	Y	Y	A	A	A

Dispersal Codes: Y=Yes (Connectivity); N=No (Not Connected); A=Veg Group Absent; D=Dependent (Connectivity Depends on Habitat Outside LSR/MLSA)

Dispersal Classes: 1=Capable of dispersing up to 1 mile; 2=Capable of dispersing up to 3 miles; 3=Capable of dispersing up to 5 miles.

b) Wildlife Connectivity

The following presents the results of applying the connectivity index to the Manastash LSR and surrounding LSR/MLSA's. Refer to Appendix 1 of the "Late Succesional Reserve and Managed Late successional Area Assessment, Wenatchee National Forest, 1996 for more information about dispersal indices.

Table 6, Dispersal Indices For Low, Moderate, And High Mobility Species For The Manastash LSR.

LSR/MLSA	Distance	Low	Moderate	High	Index
To Teanaway	14.5	No	No	Yes*	1
To Milk Creek	0	Yes	Yes	Yes	3
To Crow	2.5	No	Yes	Yes	2
Overall					**2.0**

The Manastash is a large LSR that connects to an LSR on the west side through a low pass in the Cascade Mountains. This is one of few areas in which the topography of the Cascades allows this kind of a connection. As a result of this, this area is important for east-west movements of spotted owls.

The ability of species to move from the Manastash LSR to the Teanaway or other LSR's to the north is dependent upon species being able to disperse through the AMA, specifically Snoqualmie Pass. A more thorough, site specific and scientifically rigorous assessment of this area to provide for dispersal of this species is needed. In addition, any additional development, especially along the Snoqualmie Pass area could greatly reduce the ability of this area to provide for wildlife dispersal.

C. Analysis Within the LSR

1. Unique Habitats And Species

The following is the discussion and results of the Unique Habitat and Species module for the Manastash LSR. See Module Appendix for order, explanations and process of modules.

a) Forest-wide Overview of Unique Habitats and Species:

Each LSR/MLSA can be evaluated for biodiversity, connectivity and function (see Function of Unique Habitats in the main body of the Forest-wide Assessment). Past management activities affect the function of unique habitats and species. For the Manastash LSR these include: total open road density of 2.47 miles per square mile: security habitat of 22%; roads and trails in riparian reserves of 2.99 miles per square mile; and past harvest activities of 25% in the LSR. The following describe abundance, connectivity and function for unique habitats and species.

(1) Abundance and Ecological Diversity

Compared to all the other LSR's, the Manastash is the third highest in providing high amounts of acreage and wide variety of plant communities and environments. This includes acreage for unique plant and animal habitats, juxtaposition of habitats, availability of wilderness or areas of rarity, and known observations from the plant and animal species list.

(2) Connectivity for Unique Habitats and Species

The Manastash has the highest quality of providing high connectivity in a landscape pattern for biological flow to sustain unique animal and plant communities. This includes the amount, percent and number of patches of late successional habitat, forest interior habitat patches, and the juxtaposition of wilderness and areas of rarity.

(3) Process and Function of Unique Habitats and Species

The Manastash is in the moderate group for the Forest in providing quality functioning for unique species and habitat. This includes development and maintenance of unique ecosystems, including ecological values for unique species and populations. The plant and animal species list for known observations makes up a large part of this analysis, as well as proximity to wilderness and areas of rarity, which sustain habitat function.

Identified areas of high abundance, connectivity and function for unique habitats and species in the Manastash LSR are:

- **Quartz Mountain** (Shoestring Lake to Taneum Lake to South Fork Headwaters Quartz Creek): Wetlands, Natural Openings, Riparian Reserves, Meadows, Talus, Forest Interior, PETS spp, Elk Summer Range, Big-eared Bat, Bighorn Sheep movement.
- **Panther Ridge to Dry Meadow**: Riparian Reserves, Wetlands, Talus, Natural Openings, Forest Interior, Excellent Security Habitat, PETS Spp..
- **Mt. Clifty** (Windy Pass to Upper Pileup Creek): Deciduous Forest, Talus, Riparian Reserve, Natural Opening, Meadow, Forest Interior, Mountain Goat.
- **North Fork Little Naches**: Wetlands, Meadows, Riparian Reserves, Talus, Forest Interior, Elk Calving, Special Interest Area.
- **Naches Pass**: Riparian Reserve, Forest Interior, Marbled Murrelet Habitat, Special Interest Area.
- **Upper Bear to Upper Mathew:** Riparian Reserves, Security Habitat, Excellent Forest Interior, PETS Spp.
- **Blowout Mountain to Green Pass:** Meadows, Talus, Riparian Reserve, Wetlands, Marbled Murrelet Habitat.
- **Lankin Spring to Cedar Creek Meadows**: Wetlands, Talus, Natural Openings.
- **Manastash Ridge** (Upper Manastash Creek): High Elevation Forest Interior
- **West Fork Little Naches** (to Bear Creek to Upper Big Creek to Jim Creek): Extensive Wet Forest Interior.
- **Lower Big Creek** (Lower North Ridge): Forest Interior, Security Habitat, PETS spp, Riparian Reserves.
- **Mole Mountain to Taneum Lake**: Security Habitat, PETS spp., Elk and Goat Summer Range
- **Taneum Creek**: High Amounts Riparian Reserves, PETS spp.
- **Quartz Creek and South Quartz Creek**: Riparian Reserves.
- **Little Creek**: Riparian Reserves, Talus, Forest Interior, Security Habitat, PETS spp.
- **Caseknife:** Security Habitat, PETS Spp.
- **Lodgepole Creek**: Security Habitat, PETS Spp.

The following is a summary of the Unique Habitats and Species Module. For more information see Unique Habitats Map and Tables, Forest Interior Map and Tables, Riparian Reserves and Roading Map and Tables.

b) Unique Habitats and Species Module

(1) Landscape Analysis

Forest-wide the Manastash is of high quality for providing unique habitats and species abundance. It provides the highest amount of connectivity for unique habitats and species. The difficulty of developing and maintaining unique habitats and species in this LSR is more challenging due to the large amounts of interspersed private land and the I-90 corridor.

The Manastash LSR is not known for being a distribution center for areas of rarity or endemism, as per Columbia Basin Ecosystem Plan. There are no Research Natural Areas. There are two Special Interest Areas from the Forest Plan: North Fork Little Naches and Naches Pass Special Interest Areas.

(2) Micro-site Analysis:

RIPARIAN RESERVES
14% of LSR (14,513 acres), high amounts
Streams, Wet Meadows (297 acres), Seeps, Lakes, Open water (60 acres)

NON-FORESTED VEGETATION 7% (7,371 acres) of LSR
Talus 2% (2,308 acres), Rock 1% (738 acres), Cliff (130 acres),
Subalpine Meadows 1% (856 acres), Dry Meadows (50 acres),
Natural Openings 3% (2,689 acres),

UNIQUE FORESTS
Forest Interior Patches 21% (22,110 acres)
Dry Forests; Disjunct Cedar, Pacific Yew, Alaska Yellow Cedar, Buffalo Berry.
Snags/Logs Medium Quality from Landscape Level

SURVEY & MANAGE
PROTECTION & BUFFER
55 Species of Special Animals
Long-eared Myotis;
Black-backed, White-headed woodpecker, Pygmy Nuthatch, Flammulated Owl,
Papillose Tail-dropper,
32 Species of Special Plants: Fungi, Lichens, Vascular Plants (*Cymo, Botrychium* spp)

PETS
Fisher, Goshawk, Spotted Owl, Bald Eagle,
Olive-sided Flycatcher, Tailed Frog, Cascade Frog, Bighorn Sheep.
Plants: *Orbanche pinorum*, *Carex interrupta*, *Botrychium* spp.

MIS
Elk, Mule Deer, Pileated Woodpecker, 3-Toed Woodpecker, Marten, Beaver, Mtn Goat

AMERICAN INDIAN USES
Traditional Use Sites: Vision Quest in Talus; Trade routes to the westside
Food Gathering: Elk, Deer, Mountain Goat

c) Manastash Potential Treatments For Unique Habitats And Species:

- Reduce noxious weed spread in meadows and natural openings;
- Reduce noxious weed spread in clearcuts and partial cuts through-out the LSR,
- Reduce roads and Off Road Motorized Trails in Mountain Goat Habitat;

- Increase Security Habitat;
- Reduce roads in forest interior patches;
- Remove roads/trails from talus and Riparian Reserves;
- Remove roads and trails in wet meadows;
- Protect large trees and screen near talus, cliffs, caves, meadows;
- Retain American Indian access to traditional use sites;
- Meet high end snag levels and spp;
- Reduce encroaching trees in subalpine meadows; where fire historically maintained them as meadows,.
- Use prescribed fire in ponderosa pine with low density and large tree sizes;
- Protect riparian areas from grazing;
- Protect/maintain/enhance/monitor PETS;
- Thin to accelerate late successional characteristics in areas near private land;
- Interpret values and protection/maintenance of unique habitats and species.
- Acquire non-Forest System lands with high degree of unique species or habitat
- Monitor and maintain unique habitat concentrations;
- Monitor and maintain connectivity corridors.

d) Snag/Log/Green Tree Recruitment Module

The following is the discussion and results of the Snag/Log/Green Tree Recruitment sub-set module of the Unique Habitats module for the Manastash LSR. See appendix for order, explanations and process of modules. Snag quality can be judged by a continual supply of tree structure in various stages of decay, size and species. This can be best provided in the moist and wet vegetation groups, areas with large amounts of late-successional habitat, areas with little fragmentation, areas with high amounts of forest interior, and areas with well functioning riparian reserves.

A landscape level approach was used to analyze snag, green tree recruitment, and downed wood habitat in the Manastash LSR. The landscape approach reviews the quality of snag, down logs, and green tree recruitment for the LSR's. GIS and specific knowledge was used including: forest vegetation types and acreages, amount of forest burned, percentage of past timber harvest (clearcuts and partial cuts), road densities, security habitat, Riparian Reserve acreages, pathogens, the number of spotted owl home ranges, forest interior amounts, and the percentage of late successional habitat. The qualitative analysis for the LSR included green tree availability, short term and long term snag/log availability, burn intensity, site specific wildlife needs, land allocation goals, and the quality of refugia/security habitats.

(1) Quality Rating

Each attribute for snag/downed log/green tree recruitment has a rating (see table below), a final rating incorporates all values towards one rating for the LSR. Actual snag, downed log and green tree recruitment numbers, sizes, stages of decay and species is not practical to analyze on a landscape basis. This can also be done on a 40 acre grid, or sub-watershed basis. When data is available, incorporate actual availability data into the analysis. Snag and Downed Log levels are based on "Wenatchee National Forest Snag Levels, Fire Recovery Snag Levels", Everett et. al.; spotted owl and snag studies, and wildlife needs. Qualitative ratings are based on habitat needs for snag, downed log, and recruitment tree wildlife and plant species. Species using these habitats may include:

pileated woodpecker	spotted owl	hoary bat
black-backed woodpecker	flammulated owl	silver-haired bat
white-headed woodpecker	great gray owl	big brown bat
tailed frog	lichens & fungi	lynx
NW & PG salamander	land snails	flying squirrel

bald eagle	marten & fisher	voles, shrewmole
olive-sided flycatcher V	Vaux's swift	

Table 7, Snag Habitat Quality/Landscape Scale (Percentages in bold indicate values for Manastash)

HIGH QUALITY	MEDIUM QUALITY	LOW QUALITY
Moist & Wet Veg Groups **73%**	Subalpine Fir & Mesic Veg **13%**	Dry & Whitebark Veg **6%**
>60% LS (non-dry) Habitat **66%**	15% - 60% LS Habitat	<15% LS Habitat
80% - 100% LS (all) Habitat **71%**	40% - 80% LS/M Habitat	<40% LS/M Habitat
> 30% Forest Interior (non-dry)	15% -29% Forest Int Non-dry **21%**	<15% Forest Interior Not Dry
>10% Forest Interior Dry	5% - 9% Forest Interior Dry	< 5% Forest Interior Dry Trace
>16% in Riparian Reserves	10% to 16% in Riparian Reserves **14%**	<10% in Rip Res
0 Mi/Sq Mi Any Rds in Rip Res	0 to 1 Mi/Sq Mi Rds in Rip Res	> 1 Mi/Sq Mi Rd Rip Res **2.99 mi/sq/mi**
< 1 Mi/Sq Mi Open Roads	1 Mi to 2.5 Mi/Sq Mi Roads **2.47 mi/sq/mi**	> 2.5 Mi/Sq Mi Roads
>70% Security Habitat	50% to 70% Security Habitat	<50% Security Habitat **22%**
>10% in Past Burns		<10% in Past Burns **3%**
>50% Insect/Pathogens (see Insect/Disease Write Up)	25% - 50% Insect/Pathogens	< 25% Insect/Pathogens
<10% Past CC Harvest	11% - 25% Past CC Harvest	>25% Past CC Harvest **30%**
<10% Past PC Harvest	11% - 50% Past PC Harvest	>50% Past PC Harvest **50%**

(2) Restoration Opportunities And Potential Projects For Snags/Logs

Reduce roads in riparian reserves;
Retain Snags at High End of Range;
Complete snag analysis on 40 acre grid
Reduce Roads in Forest Interior Patches
Incorporate Sustainable Insect/Disease Levels,
Increase Security Habitat

e) Species with Special Status (Plant)

Within the Manastash LSR, there is potential habitat for a number of special status species, but few surveys have been carried out to determine presence or absence. Surveys should be carried out in conjunction with restoration projects, as well as surveys independent of other activities. It is important that species ranges are known so that better estimates of species viability can be assessed. In addition, little is known about most rare species habitat and biological requirements, and inventories provide a first and necessary step in obtaining this information.

There are three Forest Service sensitive species within the Manastash LSR; *Botrychium simplex, Carex interrupta,* and *Orobanche pinorum*. Information regarding the biology or ecology of these species is limited, but some information is summarized here.

Habitat information regarding *Botrychium* species has been collected and summarized in a number of publications, as well as local information specific to habitats the Manastash LSR (on file at the Naches Ranger District). *Orobanche pinorum* is known from several independent locations within the Manastash LSR. In general, *O. pinorum* occurs on steep, exposed slopes with loose shallow soils. This species is most closely associated with Douglas-fir and grand fir plant associations. The occurrence of *O. pinorum* is largely dependent on the presence of *Holodiscus discolor*, as *O. pinorum* is a parasite on the *H. discolor* roots. Populations of *Carex interrupta* are well distributed along streams in the southern portion of the Manastash LSR. *Carex interrupta* typically occurs on along rocky, sandy streambanks and is generally associated with running water.

f) Survey and Manage Species (Plant)

There are a number of survey and manage plant species known to occur in the Manastash LSR (Appendix 7). A few species are suspected, even more are simply unknown (Appendix 7). The ROD provides standards and guidelines for survey and manage species, and these should be addressed within the Manastash LSR. An important point is that only very general surveys have been completed for non-vascular plants and projects should be initiated which carry out extensive surveys.

2. Connectivity (Plant and Wildlife)

a) Plant Connectivity

Connectivity can also be addressed by analyzing the connectedness of habitats or species populations within the MLSA/LSR. Within the Manastash LSR, most forest groups are fairly disconnected, largely the result of logging on private land..

Disjunct species populations result from inherent breaks or openings in the landscape. At this time, information is not available to complete this type of analysis for species with special status within the Manastash LSR.

b) Wildlife Connectivity

The following are the results of applying the within LSR connectivity module to the Manastash LSR. (See Appendix 1 of the Wenatchee National Forest LSR/MLSA Assessment for an explanation of the following ratings.)

Table 8, Manastash Ridge LSR Wildlife Connectivity Rankings

Connectivity Variable	Dry	MGF/Mesic Hemlock	Wet	SAF	Overall
%LS or FC	LS = M, FC = L	High	High	High	High
Open Rd. Dens.	Low	Low	Low	Low	Low
Security Habitat.	Low	Low	Low	Low	Low
For. Int. Roads.	Low	Low	Low	Low	Low
% Interior Forest	Low	Low	Low	Low	Low

The mixed ownership in large portions of this LSR causes concern over the connectivity for wildlife species. This is a particular concern as access over forest lands is provided for private logging. This makes it difficult to achieve the objective within this LSR of providing for a "high" level of connectivity (i.e.: <1 mi./sq. of open roads, 70% security habitat, and no roads in the forest interior).

(1) Restoration Opportunities

There are opportunities to improve the "within LSR connectivity" through active management of roads that could include closing and revegetating roads. In addition, high levels of ORV use conflict with objectives for providing security habitat. This could be improved by management of ORV use that coordinates with the objective of providing areas of security habitat that are distributed throughout the LSR and across all vegetation types.

Silvicultural practices that enhance the development of older forest structure could be applied in areas that do not currently provide spotted owl habitat. This would be particularly effective in areas identified as created opening or dense stands.

3. Disturbance Risk Analysis

Only six percent of the Manastash LSR is in the dry forest group, most of it in a successionally-advanced state. Dry forest in this LSR is concentrated in the northeast corner. The southeast corner of the LSR is mainly dry subalpine fir; vegetation between these forest types (and outside the LSR boundary) is also of drier types. Thus, fire is a primary concern along the eastern edge of the LSR. Moist and wet forest types comprise 73 percent of the LSR. These areas are usually considered at low risk to fire; however, extensive clearcuts on private lands within the LSR boundary pose a threat since slash within these harvest units remains untreated. In 1988, a fire originating west of the Cascades crest burned into the Manastash LSR. The fire spread from clearcut to clearcut, and burned into mature forest adjacent to harvest units. While the fires did not spread far into the mature forest, mortality along the edges of the harvest units increased the sizes of these non-forested areas. The fire was eventually halted when it reached harvest units on which the slash had previously been treated.

The Manastash LSR is heavily roaded, with an extensive network of ORV trails. There are few developed campgrounds; most camping is dispersed and recreational use is extremely heavy. Use during the fall hunting season is also heavy. The potential for human-caused ignitions is high, adding to the risk of fire within this LSR.

The following information on insect activity in the Manastash LSR is from data collected during the aerial surveys conducted by Region 6 Insect and Disease Group. Light infestations or damage on less than 100 acres are not reported.

- Western pine beetle: 1979
- Mountain pine beetle (lodgepole pine): 1951-2, 1954
- Mountain pine beetle (w. white pine): 1953, 1955, 1956, 1960-63, 1965, 1968-85, 1986 (heavy), 1987-93
- Mountain pine beetle (ponderosa pine): 1977, 1981
- Mountain pine beetle (whitebark pine): 1989
- Douglas-fir beetle: 1953-54, 1956, 1958, 1960, 1962-63, 1969, 1982, 1988 (heavy)
- Fir engraver: 1954, 1963, 1969, 1976, 1979, 1987, 1989 (very heavy), 1990-91 (heavy), 1994
- Spruce beetle: 1962, 1970-71, 1977
- Western spruce budworm: 1972-77, 1980, 1985
- Blackheaded budworm: 1985

Western white pine mortality associated with white pine blister rust and subsequent attack by mountain pine beetles is very high in this LSR, as is grand fir mortality from the fir engraver. The former has the effect of changing species compositions and moving vegetation towards late successional stages by selectively eliminating seral species. The latter tends to produce snags and logs in small size classes. Following a pulse of heavy mortality from fir engravers, risk for catastrophic fires increases for several years because of the vertically-connected, highly flammable fine fuels in the twigs and branches of affected trees.

Table 9, Disturbance Matrix for Manastash Ridge LSR

Veg Type	Fire	Dwarf Mistletoe		Root disease			WPBR	WSB	DFB	FE	MPB	Total
		DF	WL	AROS	HEAN	PHWE						
10	L	L	-	M	M	M	-	L	L	L	L	L
11	M	M	L	M	M	M	-	M	L	L	L	M
12	H	H	L	M	M	H	-	H	H	H	L	H
20	L	M	-	M	M	M	-	L	L	L	-	L
22	H	H	L	M	M	M	-	H	H	H	M	H
30	M	M	M	M	M	M	H	L	L	L	-	M
31	M	M	M	M	M	M	H	L	L	M	M	M
32	H	H	H	L	H	H	H	M	M	H	M	H
33	H	H	H	M	H	H	H	M	M	H	M	H
34	M	M	M	M	M	M	H	L	L	L	-	M
35	M	M	M	M	M	M	H	L	L	M	-	M
36	H	H	H	L	H	H	H	M	M	H	-	H
37	H	H	H	M	H	H	H	M	M	H	-	H
40	L	L	L	L	L	L	M	L	L	L	-	L
41	H	L	L	L	L	L	H	L	L	L	H	H
42	H	L	L	L	M	L	H	L	M	M	H	H
43	L	L	L	L	L	L	H	L	L	L	M	L
44	M	M	M	L	L	L	H	L	L	L	M	M
60	M	L	L	L	M	M	H	L	L	L	-	M
61	M	L	L	L	M	M	H	L	L	L	-	M
62	M	L	L	L	M	M	H	L	M	M	-	M
63	L	L	L	L	L	L	H	L	L	L	-	L
64	L	L	L	L	M	M	H	L	L	L	-	L
65	L	L	L	L	M	M	H	L	L	L	-	L

Key to Column Headings: PP = Ponderosa Pine, DF = Douglas-fir, WL = Western Larch, PIPO = Ponderosa Pine; PSME = Douglas-fir; LAOC = Western Larch; AROS = Armillaria root disease; HEAN = Annosus root disease; WPBR = White Pine Blister Rust; WSB = Western Spruce Budworm; DFB = Douglas-fir Beetle; MPB = Mountain Pine Beetle; WPB = Western Pine Beetle.

Key to Letters "-" = no risk; "L" = low risk, "M" = moderate risk, "H" = high risk

Forty-four percent of the Manastash LSR has a high composite risk to disturbances. Areas at risk include the dense, dry forest types, the partially-harvested dry forests, and the layered mature and partially-harvested moist grand fir and mesic western hemlock forests, and the single layered and mature subalpine fir stands, especially those that abut dry forest types. The moist grand fir and mesic hemlock types are at high risk both from adjacency to drier forests, because insect and pathogen activity has increased fuel loads and vertical and horizontal fuel connectivity within these vegetation types, and because untreated slash on mixed ownership and high recreation use increases fuel levels and ignition potential.

This LSR is a major population center for the northern spotted owl; therefore management options must take into account that protecting and enhancing habitat for this species is the primary goal. Management within this LSR will focus on protecting existing spotted owl habitat around all activity centers. Management activities will primarily take place in non-owl habitat within owl circles (e.g. fuelbreaks on south-facing aspects) or outside owl circles. Management objectives to reduce risk of habitat loss to catastrophic wildfires, insects, and pathogens include reducing stand density in non-owl habitat and outside owl circles; altering species compositions to favor fire-tolerant and insect/disease resistant species; and reducing vertical and horizontal fuel continuity outside owl circles and outside LSR boundaries. Fuelbreaks to protect spotted owl habitat in moist and wet forest types should be a priority along the eastern boundary, and wherever untreated harvest units provide a threat to owl habitat. Thinning outside owl circles within the dry, mesic, and moist grand fir forest types will help protect owl habitat from fire.

Where root disease is a major problem, altering species composition to favor resistant species will help maintain habitat over the long term. Below-ground continuity of susceptible species can be reduced by allowing group selection harvests of fir and hemlock between 0.5 to 2 acres and regenerating with ponderosa pine and western larch. Single layered stands within moist grand fir, mesic western hemlock, and wet forest types can be thinned from below to increase diameters of remaining trees and accelerate late-successional habitat. Created openings should be reforested with a diverse mixture of species.

4. Northern Spotted Owl

The following is the discussion and results of the within LSR Spotted Owl Module for the Manastash LSR. This module reviews the home range sites for spotted owls, as well as connectivity within the LSR. See Appendix 1 in the "Late Successional Reserve and Managed Late Successional Area Assessment, Wenatchee National Forest", 1996 for order, explanations and process of modules. See Suitable Spotted Owl/Dispersal Habitat and Activity Center map and tables, Forest Interior Map and tables, Riparian Reserve map and tables and Security Habitat map and tables.

a) Suitable Spotted Owl Habitat

The Manastash LSR has 66,176 acres of nesting/roosting/foraging habitat, of that 1,934 acres are in the dry vegetation type and have a low chance of sustainability. There is a potential for the LSR to have 92,577 acres in suitable habitat. The most contiguous (sustainable) suitable spotted owl habitat in the LSR is between upper Bear Creek and Upper Mathew Creek. Other areas include Quartz Mountain, Panther Ridge, upper Pileup Creek, North Fork Little Naches, Naches Pass, South Fork Little Naches, Lower Big Creek, and Little Creek. There are extensive past clearcuts that currently fragment habitat in the intermingled ownership and along old National Forest sales. To meet the recovery goals for the spotted owl, there is a need to increase/accelerate spotted owl habitat, especially accelerating old plantations and younger stands of forest.

Table 10, Dispersal and Suitable Spotted Owl Habitat by Ownership in Manastash LSR (acres)

	Forest Service	Non-Forest Service	Total
Dispersal Habitat	9,663	4,051	13,714
Dry Suitable Habitat	1,537	396	1,934
Mesic Suitable Habitat	0	37	37
Wet Suitable Habitat	43,648	22,527	66,176

b) Spotted Owl Home Ranges

The Manastash is one the "big 3" LSR's, which means management of owls will take priority over management of "at risk" vegetation. Owl home ranges will have a target of optimal habitat per owl pair, to assist recovery of the species. Currently for the Forest, that amount of acreage is 3,994 acres within a 1.8 miles radius, or 60% of the home range. The goal for recovery of the owl, is 20+ pairs of owls in the Manastash LSR. Currently, this LSR has the highest amount of sustainable spotted owl habitat, with 26 of 33 sites being over threshold, and of those 26 sites, 18 are above target. However, based on prediction of habitat loss on private lands, there could be a reduction of habitat, which would support only 11 sites over threshold.

Most of the Manastash LSR is in wetter, sustainable forest type. There is great potential to restore sustainable habitat in the wetter forest groups for long-term population viability. There is also a need to protect existing habitat and home ranges, especially in sites below threshold and target acreages. Over time, it is expected that higher quality and more sustainable habitat will be restored to the western portion of this LSR. The drier forests will eventually be managed for other late-successional species, after the northern spotted owl population has recovered.

Table 11, Spotted Owl Home Range Management Proposals To Maintain Manastash LSR, By Priority

	Status	Current	1.8 mile Circle Around Activity Center				0.7 mile Circle Around Activity Center				Quality of Spotted owl Habitat[11]						Ownership
Spotted Owl Site	PY, P, RS	NRF Hab w/n 1.8 ALL	FS Wet NRF-monitor	FS Dry NRF-protect	FS Disp-Accel NRF	Pvt NRF Acquis Coord	FS Wet NRF-Mont	FS Dry NRF-Protct	FS Disp-Accel. NRF	Pvt NRFA Acqu Cord	Forest Int	Sec. Hab.	Jux	Uniq Hab	DCA (HCP)	Owl Cluster?	
>Target Acres																	
885	PY	5459	4792	-	-	-	904	-	-	-	Yes*	Yes*	contig	RR	WD40	yes	FS
839	PY	5312	4558	-	-	-	812	-	-	-	Yes	Yes*	contig	RR	WD40	Yes	FS
829	PY	5398	5039	-	-	-	859	-	-	-	Yes	Yes*	contig	--	WD40	Yes	FS
804	PY	5395	5370	-	-	-	855	-	-	-	Yes	No	contig	RR	WD40	Yes	FS
830	PY	5008	4985	-	-	-	792	-	-	-	Yes	No	contig	RR	WD40	yes	FS
808	PY	5151	5142	-	-	-	786	-	-	-	No	Yes *	contig	Tal,RR	WD40	Yes	FS
810	P	4713	4708	-	-	-	745	-	-	-	Yes	no	contig	RR	WD40	Yes	FS
811	PY	5539	4097	-	-	-	858	-	-	-		Yes	contig	RR	--	Yes	FS
>Thresh Ac 1.8																	
894	PY	5300	3979	0	15	0	523	0	0	100	No	Yes	Inter-	Tal,RR	--	Yes	Pvt
845	PY	5590	3032	0	108	0	365	0	108	135	Yes*	Yes	--	rr,mdw wet,TFr	--	Yes	Pvt
321	PY	3807	2864	0	1064	0	665	-	-	-	No	Yes	contig	--	WD40	Yes	FS
305	PY	3662	2738	35	1221	0	320	0	180	180	No	No	Inter-	RR	WD40	Yes	Pvt
378	PY	3598	2434	303	1256	0	450	50	0	0	No	Yes	Inter-	RR	WD40	yes	FS
379	PY	3294	2349	419	1226	0	305	82	113	25	No	No	Inter	RR	WD40	Yes	FS
326	PY	2835	1888	776	1330	0	385	78	37	0	No	No	East fringe	RR	WD40	Yes	FS
818	P	5465	2672	0	0	0	363	0	0	137	Yes	No	Inter	RR	--	No	Pvt
<Thresh Ac 1.8 &	>Thres Ac 0.7																
332	P	4732	2623	0	246	40	520	0	0	0	Yes	No	Inter	Tal,RR	--	--	FS
343	PY	4493	2311	0	210	352	578	0	0	0	Yes	Yes*	Inter	Tal	--	No	FS
392	P	4764	2300	0	74	363	693	0	0	0	yes	Yes*	Inter-	Tal,RR	--	No	FS
<Thresh Ac 1.8 %	<Thres Ac 0.7																
826	PY	3569	1967	0	0	696	238	0	0	268	Yes	No	Intra-West	rr,wet, Tfrog,BT rout	WD7	No	Pvt
338	PY	3712	868	0	102	1795	288	0	11	212	Yes*	No	I-90	--	--	Yes	FS
357	PY	4290	2245	0	638	418	411	0	57	100	No	No	Inter-	RR	WD40	Yes	Pvt
349	PY	3619	2384	38	1572	241	172	0	172	230	No	No	Inter-	RR	WD40	Yes	Pvt
351	PY	3105	2018	313	1568	332	141	77	76	237	No	No	Inter-	--	WD40	Yes	Pvt
353	PY	1768	1094	574	163	99	108	147	245	0	No	No	East fringe	RR, ntr Open	WD40	Yes	FS
358	PY	4065	1941	0	386	722	363	0	74	137	Yes	Yes	I-90	RR	--	Yes	FS
327	PY	5317	2422	0	155	241	454	0	0	100	Yes	Yes	I-90	rr,mdw	WD40	Yes	Pvt
311	PY	2967	1474	793	1727	396	240	208	52	0	No	No	East fringe	RR,gos Shrub	WD40	Yes	FS
362	PY	4038	2374	0	258	289	361	0	0	133	No	No	Inter-	--	--	--	FS
368	PY	3122	1464	385	1871	814	207	65	205	228	No	Yes	--	RR	WD40	No	FS

	Status	Current	1.8 mile Circle Around Activity Center				0.7 mile Circle Around Activity Center				Quality of Spotted owl Habitat[11]						Ownership
Spotted Owl Site	PY, P, RS	NRF Hab w/n 1.8 ALL	FS Wet NRF-monitor	FS Dry NRF-protect	FS Disp-Accel NRF	Pvt NRF Acquis Coord	FS Wet NRF-Mont	FS Dry NRF-Protct	FS Disp-Accel. NRF	Pvt NRFA Acqu Cord	Forest Int	Sec. Hab.	Jux	Uniq Hab	DCA (HCP)	Owl Cluster?	
365	PY	3994	1957	87	878	619	266	3	112	2	No	No	Inter-	RR	WD40	No	FS
364	PY	3789	1599	0	330	1064	221	0	0	271	No	No	I-90	--	WD40	No	Pvt
375	RS	4610	1121	0	2	1542	70	0	0	430	Yes	No	--	Talus	--	No	Pvt

Notes on owl table above:

- Priority Owl Sites for Manastash LSR, by FS Acreage, Juxtaposition, Reproduction and Site Quality.
- Status: PY (Pair with Young); P (Pair); RS (Residential Single).
- NRF: Nesting, Roosting, Foraging Habitat for Spotted Owls
- FS Wet: Forest Service lands with wet type N/R/F
- Monitr: Monitor Site
- FS Dry: F.S. Lands with Dry type N/R/F
- Protct: Protect dry type N/R/F from risk of fire/insects
- FS Disp: F.S. lands with dispersal habitat
- Accel NRF: Accelerate dispersal habitat towards N/R/F
- Pvt NRF: Private lands with N/R/F habitat that provides owl site with needed acreage.
- Acquis Coord: Acquisition of Lands or Coordinate management of habitat and Activity Center.
- For Int: Forest Interior patches with spotted owl activity center
- Sec Hab: Security Habitat from Zone Of Influence of roads
- Jux: Juxtaposition of owl site for genetic interchange, contiguous forest blocks, intra- and inter-connectivity with other LSRs, I-90 corridor, west-side connectivity, eastern fringe.
- Uniq Hab: Unique Habitats of RR (riparian reserves), Tal (talus), Mdw (meadows), Ntr Open (natural openings), wet (wetlands), shrub patches, gos (goshawk), t.frog (tailed frog), Btrout (bull trout).
- DCA (HCP): Designated Critical Area from Plum Creek Timber Company Habitat Conservation Plan
- Owl Cluster: Cluster of 3 or more owl core areas very close together, overlapping home ranges.
- Ownership: Activity Center is on Forest Service lands or Private lands.
- * denotes high amounts of habitat, or quality.
- Habitat Acres have been modeled off of landscape vegetation analysis, suitable spotted owl habitat needs to be ground verified and mapped onto aerial photos and GIS, to accurately figure owl status.
- Restoration Opportunities: "m" Monitor site; "a" Accelerate habitat around site and home range; "p" Protect what nesting/roosting/foraging habitat exists, "c" Coordinate management of activity centers and N/R/F habitat with private land owners and/or acquire lands.

c) Spotted Owl Dispersal And Connectivity

During dispersal, nesting, roosting, and foraging habitats are used, as well as habitat of lower quality (dispersal habitat). Dispersal habitat includes single story stands, and smaller trees with at least 40% crown closure. (see Forest Interior map and Suitable Spotted Owl Habitat Map).

The function of dispersal/connectivity habitat for spotted owls depends on the amount and juxtaposition of late-successional, forest interior, and dispersal habitat. Much of the forest currently provides good connectivity for spotted owls. Roading affects connectivity in that fragmentation usually occurs along roads and removal of snags for road maintenance causes cumulatively effects in habitat over time. The Manastash LSR has a moderate amount of roads overall.

Outside the LSR/MLSA network, dispersal habitat is found in all land allocations, and will be provided mainly in Riparian Reserves, in Unmapped LSR's in Matrix, in AMA's, and in wilderness areas (NWFP 1994, Chap. 3-4 pg. 240-241).

d) Restoration Opportunities And Potential Projects

1. Meet goal for 20+ pairs of spotted owls in the LSR.
   - Accelerate Dispersal Habitat to N/R/F habitat around owl sites needed to reach threshold.
   - Acquire Private Lands N/R/F habitat around target owl sites to reach threshold acres first, then acquire lands to reach target acres.
   - Protect Dry Habitat around home ranges.
   - Cooperate and encourage private landowners to manage identified sites for owls.
2. Improve and accelerate N/R/F habitat, to maintain a high number of spotted owl pairs. Current habitat is 68,147 acres with the potential to increase to 92,577 acres (acreage includes both federally and privately owned land). (see individual owl restoration opportunities in Table 11, "Spotted Owl Home Range Management Proposals to Maintain Manastash LSR, By Priority"). This potential acreage is based on the following assumptions:
   - Created Openings (Clearcuts) in wet/moist vegetation groups will be habitat in 100 years.
   - Pole sized stands in wet/moist will be habitat in 50 years.
   - Clearcuts in mesic/dry vegetation groups will be habitat in 120 years.
   - Pole sized stands in mesic/dry will be habitat in 70 years.
3. Aggressively protect dry suitable spotted owl habitat outside the LSR on Matrix lands.
4. Protect spotted owl home ranges within the LSR between owl circles, by implementing risk reduction on first on non-suitable habitat, then on Dry and Mesic habitat.
5. Fuels reduction and hazard reduction occur outside N/R/F habitat in the short term, shifting the emphasis in 50 years. Accept more risk from fire and manage at the high end of spotted owl habitat Desired Conditions. Maintain spotted owl habitat at 60% of home range in "big 3 LSR's, 500 acre core areas protected, and 100 acre activity center protected.
6. Monitor/maintain connectivity outside the LSR.
7. Acquire private land sections that are essential for 20 pairs of owls (for spotted owl N/R/F habitat), or contribute to connectivity and risk reduction and connectivity to wilderness. Cooperate and encourage private landowners to manage these lands for owls.
8. Monitor spotted owl activity centers, 500 acre core and home ranges of owls, and where the acres are below Threshold (highest priority).
9. Field verify habitat within 500 acre home ranges of spotted owl sites below threshold in that core, but above threshold in the home range:
10. Increase habitat effectiveness and connectivity by reducing open roads and revegetating road beds. Especially in forest interior habitat patches.
11. Reduce road densities
12. Maintain dispersal/connectivity habitat (see unique habitats list).
13. Move LSR boundary to incorporate 804 Jungle and 811 Mathew owls (to incorporate activity center or optimum 60% home range).
14. Improve and accelerate N/R/F habitat, to maintain high number of spotted owl pairs. Current habitat is 68,147 acres with the potential to increase to 92,577 acres. (Acreage includes both federally and privately owned lands.)
15. Aggressively protect dry N/R/F suitable spotted owl habitat near activity centers as noted in Table 11.
16. Acquisition of habitat to meet threshold needs on at least 10 spotted owl activity centers and/or home ranges (see Table 11, "Spotted Owl Home Range Management Proposals to Maintain Manastash LSR, By Priority").

17. Monitor spotted owl activity centers, 500 acre core and home ranges of owls affected by timber harvest onprivate lands.

5. Aquatic

a) Summary of Aquatic Goals for Manastash LSR

1. Manage activities influencing State Water Quality standards within the basin.
2. Prevent increase in water temperature in all drainages. Work to reduce maximum summer temperatures especially in the Little Naches River, South Fork Manastash Creek and Mainstem Taneum Creek drainages.
3. Improve hydrologic function throughout the basin by reducing road densities and compacted soil surfaces.
4. Reduce surface erosion that elevates levels of fine sediments, by protecting hill slopes, road and trail surfaces and in-channel erosion that results from natural and disturbed banks.
5. Improve water storage capacity in meadows and floodways where soil compaction and disturbance has occurred.
6. Reduce groundwater to surface water conversion by roads and compacted soils.
7. Evaluate road surfacing and maintenance with an emphasis on reducing sediment input.
8. Reduce or avoid increasing miles of riparian roads.
9. Manage upslope vegetation, roads and activities to increase base flows, and to avoid increase in peak flows in the basins.
10. Preserve and restore floodplain, side channel, and riparian wetland habitat, especially in C and E channel types in the Manastash LSR. Protect Hydrologically Vulnerable areas as defined by the Taneum-Manastash Washshed Assessment.
11. Improve channel conditions where management activities have altered the channel.
12. Improve in-channel Large Woody Debris (LWD)loading and future recruitment potential.
13. Stabilize and increase fish population densities within the LSR and downstream areas.
14. Improve fish passage and fry survival by installation of fish screens at un-screened ditches and by maintaining minimum low flows.
15. Protect spring chinook salmonid populations and habitat in core areas in the Little Naches River and drainage.
16. Protect and inventory upslope wetlands and ponds.
17. Restore natural disturbance regimes (landslides, fire, flood, disease) as practicable.
18. Discourage the spread of brook trout.
19. Gather more information on non-salmonid aquatic biota.

b) Key Issues for Manastash Ridge LSR

Twenty Key Issues are discussed below. These Key Issues are used to describe the aquatic condition in Manastash LSR.

1. Core fish areas have been identified within and downstream of Manastash LSR. The Little Naches Mainstem drainage is a core area for spring chinook salmon and has a known population of bull trout. The Little Naches drainage has core areas for cutthroat trout and confirmed Westslope cutthroat trout. See maps of Fish Distribution in Appendix 9 of the "Late Successional Reserves and Managed Late Successional Areas Assessment, Wenatchee National Forest," 1996.
2. Federal candidate species and other species of concern: bull trout, cutthroat trout and spring chinook populations in the Manastash LSR could be altered by management activities that affect habitat conditions.

3. Anadromous salmonid populations occur within and below Manastash LSR. Anadromous salmonids within the LSR include: steelhead, early-run (spring) chinook salmon. Summer/Fall chinook salmon are known absent.

   Concerns include the lack of abundance of anadromous fish populations which are severely reduced from historic levels, within-population genetic and life-history diversity, condition of physical habitat and condition of water quality for incubation, rearing, over-wintering, migration, and spawning. Direct human interaction or harvest of individuals may potentially reduce the fitness of the spawning population. All life stages are found to be vulnerable to impacts that are caused by management actions.

   In 1995 anadromous fish passage was restored within Taneum Creek. Steelhead have been found within the Taneum system but outside the LSR and the Wenatchee National Forest boundary. Although not yet observed within the LSR, steelhead trout and chinook salmon now have access to the Taneum system up to the natural waterfall barriers on both the North and South Fork Taneum. Manastash Creek historically contained chinook salmon and steelhead trout. Anadromous fish passage occurred up to the confluence of the North and South Forks of Manastash Creek. "Currently there are multiple water diversions and dewatering of the natural stream channel which prevent access to anadromous fish." (Taneum-Manastash Watershed Assessment, p. 68) The Little Naches drainage historically contained chinook salmon, coho salmon, bull trout and steelhead trout. Passage into side tributaries has had minor alteration from the historic situation with the building of roads and improvements within the drainage. Fish passage above Salmon Falls was renewed in the 1980's with the installation of a fish ladder adjacent to the fall site.

4. Resident salmonids. Redband/native rainbow trout occur in North Fork Little Naches, Bear Creek, Mainstem Little Naches, Big, Little, Quartz, Manastash, Taneum, Lower Yakima FPU's in the LSR. Cutthroat occur in all FPU's within the LSR. Taneum and Manastash Creeks contain eastern brook trout and historically Taneum Creek contained bull trout. The Little Naches system contains eastern brook trout and bull trout.

   Concerns include maintaining existing populations, protecting against habitat degradation, over-harvest, and non-natives.

5. Introduced species. Eastern brook trout are found in the Mainstem Little Naches, Quartz, North Fork Taneum, South Fork Taneum, Manastash, and Lower Yakima drainages.

   Brook trout can have a deleterious genetic impact on bull trout, and may impact other natives through competition for food or habitat. Habitat changes or other management that would favor brook trout over native species, or would encourage the spread of brook trout, should be avoided.

6. Non-salmonid aquatic biota: We have little data for other aquatic biota in the area. Mountain White Fish and Sculpins (*Cottus* sp.) utilize streams within the LSR. Additionally, a survey in the Manastash system identified, speckled dace, longnosed dace, torrent sculpin, shorthead sculpin, bridgelip sucker and redside shiner. These species are expected to be resident in other water courses within the LSR.

   Seven sightings have been recorded for mollusks. Five genus of mollusk have been found. They are *Pisidium sp., Haplotrema vancouverense, Columella edentula, discus cronkhitei, Punctum randolphi,* and *Deroceras laeve.* They were found near Taneum and South Fork Taneum Creek, or Kittitas Valley/Irrigation. One known systematic survey for mollusks has been undertaken in this LSR. Tom Burke (U.S. Forest Service) spent 21 hours in the Taneum Watershed Analysis area mainly during the months of September and October 1994. A formal write-up of Tom's survey is found in the TMWA, dated April 1995. No other formal survey was found at this writing.

7. Water temperature Water temperatures in the Manastash LSR has been monitored in some subdrainages between 1989 and 1995. Based on available data, the most severe temperature problems occur in the Little Naches River. However, there are opportunities throughout the drainage to less temperature problems. No clear worsening trends were documented by the data. Indications of an

improving trend occurred in Bear Creek and North Fork Little Naches within the Little Naches drainage in the Manastash LSR. Conversely, some of the most extreme (>=70 F) occurred in the Little Naches Mainstem and Blowout Creek. Fish concerns make temperature management a priority in the Naches basin and cost-effective management (maintaining or increasing stream shade) could probably improve temperatures relatively quickly. The following creeks met Forest Plan Standard of the maximum temperature less than or equal to 60 degrees F: a tributary to North Fork Quartz Creek, North Fork Quartz Creek, and lower Pyramid Creek. Maximum temperatures exceeded 60 degrees F in Matthew Creek, upper Pyramid Creek, South Fork Quartz Creek Jungle Creek, Middle Fork Little Naches, South Fork Taneum, South Fork Manastash, South Fork Taneum, Taneum, and Blowout Creek.

Managing for lower water temperatures in the LSR could include managing summer low flows, and/or groundwater - surface water partitioning. This could be accomplished by managing riparian and upslope vegetation, soils, grazing and roads.

Additional clarification and data is availalbe in Table A-12, p. 13, Maximum Summer Stream Temperatures, Little Naches Pilot Watershed Assessment, 1994.

8. Fine sediment. An increase in sediment load has an adverse effect on streams. Large increases in the amount of sediment delivered to the steam channel can greatly impair, or even eliminate, fish and aquatic invertebrate habitat, and alter the structure and width of the streambanks and adjacent riparian zone. Sediment levels are a concern because they can cause failure of redds; increased suspended sediments will reduce the penetration of light and can reduce primary production, increase heat absorption, and delay initiation of bedload transport.

   Bedload is the material transported downstream by sliding, rolling, or bouncing along the channel bottom. Bedload is an important component of the total sediment load of a stream; it can determine the amount of micro habitat available for juvenile fish and invertebrates. Large amounts of easily transported bedload tend to fill in pools and reduce the larger-scale features that are important habitat. In general the courser material provides more habitat space, where as fine sediments tend to fill up the interstitial spaces between larger particles.

   Common causes of sediment entering streams are: roading, recreation, human settlements, timber harvest, fire, grazing, mass wasting and mining. Opportunities for all eight types of sediment input exits within the LSR. Little Naches, Pyramid Creek, Middle Fork Little Naches, South Fork Little Naches and North Fork Manastash, South Fork Manastash, North Fork Taneum, Mainstem Taneum have fine sediment data available. Data for these sites show varying sediment loads, overall the sediment levels are high, with some failing to comply with the standards established in the Wenatchee National Forest Plan.

   Generally, riparian areas that are accessible by vehicle are being impacted by dispersed camping. Attracted by water, campers tend to use sites as close to the water as possible. (Kevin Burke's Study) Soils within the watershed are highly varied in terms of depth and textures. In portions of the watershed the soils are well developed and generally deep. Other areas are characterized by shallow soils. Basalt is the predominate parent material:

   Additional clarification and data is available in:

   - Little Naches Pilot Watershed Assessment, table A-27, Percent Fine Sediment by Reach Table, p. 28.
   - Taneum-Manastash Watershed Assessment, p 71- 74 and, Hydrologically Vulnerable Areas and Unique Habitats maps are A-11 and A-23.

   Sediment transport. Sediment mapping Little Naches Pilot Watershed Assessment Appendix C-7/14 and Causal Mechanism Report Summary, Appendix B. Table A9 Sediment Delivery Potential shows a break down of streams in the Little Naches portion of the LSR. 71% of the FPU's area within the Little Naches drainage have high or moderate sediment delivery potential. The headwaters of the drainage systems within the Manastash LSR lie primarily in a region of sediment input and transport.

Mass wasting is not likely a major factor to channel morphology. The mainstem channels exhibit localized areas of severe bank disturbance resulting in fine sediment deposition and aggradation conditions. The major tributaries in the upper basins have the potential to transport sediment to the mainstem; their gradients, bank conditions and levels of disturbance suggest their influence should be investigated. Fine sediment (<1mm) is generally abundant in pools in the mainstem. The 1995/96 floods moved a large amount of sediment; monitoring samples in 1996 will be of interest.

Floodplain areas within the Manastash LSR act as a region of sediment deposition. Sediment levels of concern occur in the South Fork Manastash, Bear Creek, Pyramid Creek, North Fork and South Fork Little Naches Rivers where samples failed to meet the forest plan standard. The sediment sampling period is limited, so it may be premature to draw conclusions at this time.

9. Channel complexity. Channel complexity has implications for fish habitat and for the hydrologic regime (hydraulic retentivity). Components of channel complexity include: large woody debris (LWD), pool abundance, pool type, pool depth, width:depth ratio, substrate diversity, sinuosity, cover, undercut banks, bank vegetation, riparian vegetation, roughness coefficient, hydraulic retentivity, riparian wetlands, side channels, high flow refugia, and floodplain connectivity.

   LWD plays key roles in streambed and streambank stability, fines/gravel retention, sinuosity, pool formation, side channel creation, nutrient retention (e.g. deciduous leaves, salmon carcasses), and nutrient input. Single pieces function differently from interwoven masses of LWD known as complexes.

   Management can adversely impact aquatic LWD regimes in a number of ways including: removal from channel; removal from floodplain (down and/or potential); alteration of floodplain area or of frequency of "small" floods; removal from hillslope; or alteration of disturbance regimes controlling input (landslides, avalanches, fire, flood, disease). Input mechanisms for LWD include: small scale riparian disturbances to large scale hillslope disturbances.

   Most of the riparian segments in the LSR contain good LWD recruitment potential. Some sections are inhibited from recruitment by roads and numerous dispersed camp sites and grazing within the riparian zone. Riparian road density is often inversely related to channel complexity. Our information on channel complexity is far from complete; riparian road density, LWD and pool abundance data are available for selected (R6 protocol - surveyed) streams. The riparian vegetation along the mainstems within the LSR consist mainly of mature and old conifers with some mixed canopies. Some canopy closure problems occur because of braiding of the stream channel and bank exposure.

   Areas along Manastash Creek were found to be deficient in LWD, below forest plan standards. Most of the recreation occurring in the Manastash drainage is from dispersed user created campsites and the use of vehicles off road. In the Taneum drainage, recreational use in the riparian reserves, both from foot traffic and motorized vehicles has resulted in the loss of riparian vegetation that provides root strength to hold stream banks. Recreation use in the riparian reserves has also led to soil compaction reducing the vigor and survival of vegetation. Compaction leads to a reduction in the water storage capabilities of the riparian reserves.

10. Aquatic nutrient cycling depends in part on riparian understory vegetation, groundwater /surface water partitioning, in-channel LWD, hydraulic retentivity, pool depth and character, macro-invertebrate community structure, mass wasting disturbance regime, and returning anadromous biomass. We have inadequate data to evaluate aquatic nutrient cycling in Manastash LSR at this time; however we can be aware of it when managing any of the above inter-related factors.

11. Landtype. Manastash LSR includes landtypes B, C, D, E, F, and H. (see Landtype map in the Appendix 21 of the "Late Successional Reserve and Managed Late Successional Area Assessment, Wenatchee National Forest," 1996.

12. Channel type. In the absence of human influence, valley shape and geology determine the basic character of the stream channel. A steep boulder torrent, a moderate but continual step - pool - step, a broad meandering river, or a cliff-lined canyon, present different opportunities for aquatic biota. A

given organism might require a number of different channel types for different aspects of its life. Various classification systems, such as Rosgen, have been developed to characterize these differences. Common and fundamental to all systems are: 1) channel gradient, 2) channel confinement (the ability of the stream to move back and forth, or express sinuosity, often quantified as the width of the valley floor relative to the width of the channel), and 3) substrate size (whether the local geology provides huge boulders, moderate cobbles, or only sand and silt to the channel).

Channel type is a fundamental constraint on many other aquatic habitat parameters. The pools found in a steep boulder torrent will be fundamentally different from those in a broad meandering river in abundance, type, and depth. Human influences can alter conditions within a channel type (a meandering river could become shallower, silt filled, and lacking in riparian cover) or the channel type (a deep winding meadow trout stream could become a downcutting gully). If the channel type itself has been altered, it may never be possible to return a stream to its original condition; however it may be possible to improve the channel condition that moves it toward the characteristics of the original, or at least stabilizes the channel (for example prevent further downcutting).

Channel types vary not only in their natural character (or range of variability of key parameters) but vary also in which human actions they respond to, the degree of their response, and how the response is manifested

An historic/current channel type analysis of Manastash LSR was completed in drainages covered by the watershed assessments. Big and Little Creek typing needs to be done. As a broad generalization, "A" (high gradient) channel types may present the greatest slope failure concerns, "B" (moderate gradient) channel types may be most stable and most resistant to management impacts and "C" and "E" (low gradient) channel types may be the most sensitive to on-site or upstream management impacts. C and E channel types provide key unique habitat for salmonids and other biota.

Meadows adjacent to C and E channel types may be a priority for riparian road removal, human recreation reduction, and reduction in riparian grazing impact.

13. Peak flows. The rain on snow floods of 1995/96 caused considerable damage to human habitat elements while aquatic habitat for other organisms was improved over all. Some moderate peak flow events are necessary to maintain the substrate and channel conditions required by salmonids and other biota.

    Typically there were flood stage events where flood stage exceeded the annual bankfull levels and damage to public facilities such as roads and bridges was documented in the local newspaper. From this data it was calculated that prior to 1972 for the Taneum/Manastash Creeks, the interval between flood events ranged from 11 to 16 years, with an average of 13 years. After 1972, the interval appears to have compressed, suggesting possibly more frequent flood occurrences. From 1972 to 1990 the interval between over bank flooding ranged from 2 months to 7 years, with an average of approximately 3 years.

    Protection of C and E channel meadows, side channels, and other floodplain areas, and careful upslope (vegetation, soil, wetland, road, grazing and recreation) management will help mitigate peak flow impacts on humans.

14. While normal low flows are necessary for salmonids and other biota, extreme low flows can strand organisms, reduce habitat, create passage barriers, increase water temperatures, and reduce the stream's ability to transport fine sediments. The management factors above that mitigate peak flows will also mitigate low flows. Water withdrawal in the off forest/lower portion of Manastash Creek are of particular concern.

15. Water Withdrawal. No water withdrawal site exists within the Little Naches drainage portion of the LSR. There is presently one public water diversion in the Taneum/Manastash watershed, the water supply system for the Taneum Campground. There is also a small earth fill dam and water impoundment in Hereford Meadow in the South fork Manastash drainage. Historically, this

impoundment was used for hydraulic mining activities in the Hereford Meadow area. Numerous water diversions exist below the LSR in the lower drainages.

16. Road density. Road density is related to many other issues including fine sediment, mass failures (biotic passage barriers, coarse sediment input, LWD input), effective channel network (increased), hydrograph (peak flows, low flows, water temperature, biotic migration/passage, water/sediment balance, aggradation/degradation), groundwater/surface water partitioning (areas of groundwater upwelling have been documented as key winter thermal refugia for salmonids and may support unique flora/fauna; this is also a water temperature issue). Riparian roads have additional issues of floodplain loss, meadow functioning disrupted, channel constriction and simplification and human presence (potential harvest, disturbance of spawning, habitat degradation, introduction of non-natives).

    Total riparian road density in Riparian Reserves are 2.99 miles per square mile in Manastash LSR. The Riparian Reserves are estimated as 14,513 acres (14 %) of the 104,661 acres within Manastash LSR.

    Road management strategies include: 1) relocating riparian roads, 2) reducing the abundance of upslope roads to leave only a well planned core access network, and 3) reducing road-related surface erosion through such actions as frequent maintenance, surfacing, outsloping, driveable dips, seasonal closures cut-and-fill plantings or coverings, and culvert replacement or maintenance. These management actions are predicted to lead to immediate, long-term, widespread "improvements." Allowing the Riparian Reserves to returns towards the natural condition of the water/sediment balance, fine sediment abundance, channel complexity, riparian health, and water temperature. Because of a high probability of improvement, and because these are fundamental parameters within which finer scale parameters (such as spawning gravel condition or pool abundance and depth) operate, road repair is generally a management action of high priority, high return, low risk, and nearly universal applicability.

    In the areas of relative high and moderate risk, it is recommended that road densities, stream crossings and landscape disturbances be mitigated to restore the natural flow paths of water. The following sub-drainages fall into the high and moderate risk categories: Butte Creek, Middle North Fork Taneum, Upper North Fork Taneum, Lower North Fork Taneum, First Creek, Lower South Fork, Shadow Creek, Tarmarack Spring, Mainstem Taneum, Cedar Creek, Ice Water Creek, Middle South Fork Manastash, Walter Creek, Frost Creek, Shoestring Creek, middle mainstem North Fork Manastash, Willow Gulch, Upper North Fork Manastash, and other unnamed streams.

17. Upslope vegetation has profound importance for the yearly streamflow pattern (hydrograph), affecting peak flows, low flows, and total yearly flow, as well as the timing of these flows. Percent canopy closure, or clearcut acres, are measures often used to address this issue. Human management may have reduced the canopy in the watershed (usually through timber harvest) or increased canopy in the watershed (usually through fire suppression). Overstory canopy may have the greatest effect but understory vegetation, condition of the duff layer, and soil compaction are inter-related and also important, particularly in areas of drier climate. Vegetation, climate (precipitation patterns, rain-on-snow probabilities, and lightning strike patterns), and landtype interact.

    As previously described, portions of the LSR are a 'checkerboard' layout of private and federal land ownership. The private lands have largely been harvested or are scheduled for timber harvest. Many acres of federal land have also been harvested. Concern for harvest levels in the upper Little Naches drainage has been revisited by planners since the mid 1980's. Falls Creek fire started west of the Cascades crest and moved eastward consuming untreated logging slash and live trees. The fire traveled from one area of untreated slash to the next. Much of the timber harvest included units that left no riparian corridors, thus the headwaters of some of the creeks were left without cover and LWD recruitment potential.

18. Floodplain connectivity. Historic photos might reveal changes in off-channel habitat, floodplain area and riparian wetland habitat over time. Some of the floodplain area is privately owned. Within the

LSR some of the floodplain area has been altered, see discussion of timber harvest within the riparian zone and riparian roading above.

19. Upslope wetlands and ponds may serve as "islands" and/or refugia for aquatic biota, especially those that do not co-exist with salmonids. They also have important roles in regulating summer base flows in the watershed. We have information regarding wetland locations, but little understanding of alterations in their ecosystem functions over the last century.

    As a broad generalization wetlands, especially in late-successional forests may be havens of biodiversity warranting very conservative management until better inventoried and understood.

20. Aquatic Disturbance Regimes. We have come to recognize that suppression or alteration of natural disturbance regimes can lead to fundamental long-term resource change. This in turn has led to the realization that minimum viable populations or habitats must be large enough to withstand moderate disturbances. A complete description of natural disturbance regimes, their relationship to landtype, climate, and other factors, and their ecosystem roles, is still lacking. Aquatic systems are now seen to depend on disturbance by fire, flood, insect/disease, and landslides for input of the raw materials of channel construction, such as LWD and coarse substrate.

    The LSR system comprises a set of landscape patches where retention or recreation of primeval conditions are emphasized, maintaining the wildlife dependent on these conditions. From the aquatic perspective, we consider how this system of reserves and the aquatic corridors that link them can be managed for maximal viability of native aquatic species and the habitat conditions in which they evolved.

    Although historic aquatic conditions are not known to the degree desirable this much is clear: many aquatic populations have lost some of their spatial, temporal, and genetic "safeguards;" the nature of the disturbances they experience has changed; individual health/reserves may be reduced (for example salmon enduring longer migration times concurrent with higher temperatures); and habitat conditions have declined in non-random ways, fragmenting populations. The LSR network has the potential to strengthen viability of these at-risk aquatic populations.

6. Noxious Weeds

Six noxious weed species were identified to occur within the Manastash LSR. These species are discussed in priority order as identified by the noxious weed analysis module. There are no Class A weeds presently documented from this area. Class B-designate weeds include: *Centaurea diffusa, Cytisus scoparius,* and *Chrysanthemum leucanthemum.* Class C species present include *Hypericum perforatum, Cynoglossum officinale,* and *Cirsium canadensis.* These species are found along roadsides within the LSR. Following through the noxious weed analysis module; *Cytisus scoparius, Cynoglossum officinale*, and *Cirsium canadensis* are limited in extent and should be controlled or eradicated. The other species are more widespread and containment and prevention of spread should focus on areas of high recreation use. Harrod (1994) provides a brief synopsis of control methods available and provides recommendation for noxious weed management.

7. Fire Management Plan

a) Overview

This plan is intended to provide guidance for the management of fire in the Manastash LSR. It is intended to supplement the Fire Management Plan for the Late Successional Reserve System (see "Late Succesional Reserve and Managed Late Successional Area Assessment, Wenatchee National Forest," 1996) and will become a portion of the Fire Management Action Plan for the Wenatchee National Forest.

The disturbance regimes for the vegetation groups have been described in a separate portion of this plan. It is the intent of this plan to provide adequate protection of the reserve to allow management practices to be initiated which will provide for the protection of the late successional associated species and associated

unique habitats. These management actions are expected to include actions which will include the role of fire disturbance as an important process in the reserve.

b) Fire Prevention Actions

The following actions are site specific for the Manastash LSR. They are intended to supplement the actions which will be implemented on a Forest wide basis.

1. Continue to implement campfire restrictions as warranted by increased fire danger.
2. Initiate hazard reduction around developed and dispersed recreation sites and organizational camps such as:
   - Kaner Flat
   - Crow Creek
   - Taneum Junction
   - Longmire Meadow
3. Emphasize fire prevention activities along major loop roads and high use dispersed sites such as FS Road 1900 and FS Road 1901 - 1903 on the Naches District and Forest Roads 3100, 3120, 3330, 3300, and 3350 on the Cle Elum District.
4. Continue and improve fire prevention signing program on roads and trails included or adjacent to the LSR. Coordinate with the district-wide signing program.
5. Make public user education geared to fire danger an emphasis item.
6. Implement road restrictions and closures as warranted during periods of extreme fire danger.
7. Emphasize contact with the following special interest groups: ORV groups, local user groups, grazing permittees, Plum Creek Timber Company, timber harvest and road building contractors, and other special use permittees.
8. As a hazard reduction measure emphasize fuel wood collection around recreation use sites in the dry forest type.
9. Maintain cooperative fire prevention efforts with Yakima County Fire Prevention Association, Plum Creek Timber Company, and the DNR.
10. Coordinate with the White River Ranger District (Mt. Baker-Snoqualmie NF) on fire prevention plans, primarily along forest service road 1914.
11. Utilize cooperative law enforcement agreements to emphasize the inspection of spark arresters and exhaust systems.

The following methods are proposed to protect the LSR from fires originating outside Reserve boundaries.

1. Complete pre-attack planning process for LSR; utilize natural fuel breaks.
2. Stress prevention of fires outside LSR boundaries.
3. Strategic fuel manipulation to reduce size and intensity of fires within and adjacent to LSR boundaries e.g. fuel breaks - tie together existing fuel treatment areas utilizing natural openings, roads, ridgetops, etc. Priority areas are the ridge between Milk Creek and Quartz Creek; the ridge between Bear Creek and the west fork of Bear Creek; the ridge between the North Fork of the Little Naches River and the West Fork of Bear Creek; and Jungle Ridge.
4. Maintain existing pre-attack facilities (water chances) and seek opportunities for more, including helispot locations.

c) Fire Detection

1. Use temporary lookouts on Quartz and Frost Mountains (lookouts have been removed) aerial detection after lightning episodes will provide the primary detection resource for this LSR.
2. These temporary lookouts will be supplemented by emergency staffing at Little Bald, Raven's Roost, and the Kaner Overview (mountain with encompassing vista) during and after lightning episodes.

3. Educate local residents, users, campground concessionaires, cooperators, and the state DOT on how to report fires.

d) Fire Suppression

1. Owl activity centers are the priority for protection. All fires in the 1.8 mile buffer will be suppressed at minimum acres.
2. Aggressive Initial Attack will occur on all dry site ecosystems until vegetation management projects have modified the vegetative condition to where it is in synchrony with inherent disturbance regimes, recognizing the fluctuation in funding levels and the ability to meet the objectives.
3. Tactical suppression activities will take into consideration specific resource values such as the protection of riparian areas and private land from fires.
4. Improvements will be a priority for protection (recreation facilities, private property, etc.)
5. Pre-planned dispatch cards for initial attack will be prepared for the LSR area
6. The Fire Situation Analysis and the Escaped Fire Situation Analysis process will be used to guide initial attack, Extended Attack, and large fire-suppression. Utilize pre-attack plans and materials.
7. Protect known threatened and endangered species habitat from fire (botanical).
8. Fire suppression actions will be implemented on an inter-agency basis as appropriate.

e) Vegetation and Fuels Management

1. Returning dry forest types to sustainable conditions is a priority.
2. Suggested activities include pruning, thinning, commercial and pre-commercial thinning, wood gathering, mechanical treatments, and prescribed fire.
3. High density, multi-story refugia in mesic sites will be maintained as described by biologists.
4. Prevent the spread of noxious weeds as feasible.
5. Maintain a mosaic of age classes and structural conditions across the landscape outside dry forest to support species associated with late-successional forest.

f) Prescribed Fires

1. Recognize the use of prescribed fire as a primary management tool in this LSR.
2. The development and subsequent implementation of prescribed fire plans should be on a landscape level both within and adjacent to the LSR.
3. Priorities for the use of prescribed fire are dry site ecosystems including dry meadows and steppe vegetation.
4. Priority outcomes are hazard reduction and vegetation manipulation near improved sites and intermixed ownership.
5. To return landscapes to synchrony with inherent disturbance regimes, pursue opportunities to implement prescribed fire projects in a timely and economical manner.
6. Projects should attempt to minimize risk of future catastrophic wildfires (those outside the range of Inherent Disturbance Regimes with respect to size and/or severity).

g) Summary:

This plan provides guidance for fire management for the Manastash LSR. It is anticipated that changes will occur as actions are implemented within the LSR. The continuing increased use of prescribed fire is foreseen as actions are implemented to bring the dry site ecosystems in synchrony with inherent disturbance regimes.

D. Restoration Opportunities and Potential Project Summary

The following table summarizes the restorations opportunities and potential projects as identified from each module.

Table 12, Restoration Opportunities and Potential Projects, Manastash LSR

Analysis Module	Restoration Opportunity	Potential Projects	Schedule 1
Forest-Wide Sustain-ability	1) Reduce fuel loading and stocking levels in dense successionally advanced, dry forest stands where they exist outside of the LSR particularly in the lower Manastash drainage. This area is the priority.	1) Use commercial thinning, pruning, fuelwood collection and prescribed fire as described in disturbance module treatment key. Favor the development of seral species such as ponderosa pine and western larch. Locate and prescribe sufficient treatments to make landscape level changes in fire susceptibility.	A
	2) Improve and maintain the existing fuelbreak between the Manastash LSR and Milk Creek MLSA.	2) Plant or encourage the growth of less flammable deciduous vegetation and remove down fuels from within the fuelbreak.	B
**** Forest-Wide Spotted Owl**	1) Meet goals of 20+ pairs of spotted owls.	1) Increase/Accelerate the development of spotted owl habitat within the LSR, especially in wet, moist or high elevation areas.	B
	2) Improve and accelerate N/R/F habitat to maintain high numbers of spotted owls.	2a) Rehab and accelerate habitat in areas degraded or lost due to past harvest, fires or insects. 2b) Thinning of overstocked stands to accelerate the development of late successional characteristics.	B
	3) Reduce fuel loading and stocking levels in dense successionally advanced dry forest stands where they occur outside of the LSR, particularly in the lower Manastash drainage.	3) Use commercial thinning, pruning, fuelwood collection and prescribed fire as described in the disturbance module treatment key. Favor the development of seral species such as ponderosa pine and western larch. Locate and prescribe sufficient treatments to make landscape level changes in fire susceptibility	A
	4) Increase knowledge regarding spotted owl activity centers below targeted habitat acreages.	4) See list of owl sites in need of monitoring for site tenacity and reproduction status.	C
Forest-Wide Connectivity	1) There is some plant disconnectivity associated with the Manastash LSR.	1) None Identified.	N/A

Analysis Module	Restoration Opportunity	Potential Projects	Schedule [1]
	However, it is inherent within the landscape.		
	2) Spotted owl dispersal to LSR's to the north is uncertain due to the I-90 corridor.	2) Conduct detailed analysis to determine owls ability to disperse through the Snoqualmie Pass AMA.	A
Unique Habitats and Species	1) Reduce road and trail densities in riparian reserves, talus, meadows and wetlands.	1) Close or relocate roads and trails as opportunities are identified in Access and Travel Management Planning.	A
	2) Increase the amount of interior forest area within the LSR.	2) Close roads near interior forest areas as opportunities are identified through Access and Travel Management Planning. - Accelerate late successional forests.	A
	3) Improve habitat effectiveness.	3a) Reduce open road densities to increase security habitat as opportunities are identified in Access and Travel Management Planning. 3b) Protect riparian areas from grazing. This may be for either big game or domestic livestock or both, dependant upon how best to meet riparian wildlife objectives.	B
	4) Provide access for American Indians.	4) Maintain road access where necessary for cedar basket gathering, huckleberry gathering, vision quests, etc.	A
	5) Increase public awareness of unique habitats and values.	5) Interpret unique habitats through signs, brochures, video tapes, etc.; interpret special values of micro-site habitats and unique species.	C
	6) Increase Federal Ownership of areas with abundance of unique habitats and species.	6) Acquire selected lands through exchange or purchase.	C
Connectivity Within the LSR	1) Promote the development of older forest structure.	1) Thinning in younger dense forest stands.	C
	2) Reduce the effect of roads and ORV trails on connectivity within the LSR.	2) Close or revegetate roads as opportunities are identified through Access and Travel Management Planning.	B

Analysis Module	Restoration Opportunity	Potential Projects	Schedule 1
Disturbance	1) Reduce the risk of habitat loss to wildfire by reducing stand density, altering species composition and reducing vertical and horizontal fuel continuity in dry forest types. (Vegetation Type #12 - Dense successionally advanced.)	1) Use commercial thinning, pruning, fuelwood collection and prescribed fire as described in disturbance module treatment key. Favor the development of seral species such as ponderosa pine and western larch. Priority areas for treatment of this stand type are: 1) Outside the LSR, particularly in the lower Manastash drainage. 2) Within the LSR but outside of home range. 3) Over target acres (area above 3,994 acres) within the home range. 4) Target acres within the home range while maintaining suitability.	A
	2) Minimize the extent of stand replacement fires within the LSR and minimize the spread of fire from the Manastash to other LSR's.	2a) Conduct activities that improve the effectiveness of the existing road system as fuelbreaks. 2b) Maintain the existing fuelbreak between the Manastash LSR and Milk Creek MLSA.	B
Spotted Owl	1) Protect 100 acre core areas within the 33 Manastash spotted owl activity centers.	1a) Protect the best 100 acres of nesting, roosting and foraging habitat around the activity center. 1b) Limit activities within activity centers between 3/1 and 8/31.	A
	2) Protect 500 acres of nesting habitat within the 33 Manastash spotted owl core areas.	2) No harvest activity in N/R/F habitat in 13 of the 33 core areas (See list of spotted owl core areas with less than 500 acres of N/R/F).	A
	3) Improve sustainability of dense dry forest (type 12) outside of 1.8 mile spotted owl circles within the LSR.	3) Use commercial thinning, pruning, and fuelwood collection.	A
	4) Improve sustainability of dense dry forest (vegetation Type 12) within 0.7 to 1.8 mile home range. Treatment should maintain suitability of habitat for nesting, roosting and foraging. (see spotted owl desired conditions, and see table 9 for owl site priorities.)	4) Utilize commercial thinning, pruning and fuelwood collection. -- First on non-suitable habitat, then on dry/mesic habitat. (this is an option on 10 of the 33 owl sites.)	A
	5) Improve habitat quality in	5) Utilize silvicultural activities	B

Analysis Module	Restoration Opportunity	Potential Projects	Schedule [1]
	dense single story stands on owl sites below target where these stands occur. Purpose is to attain target acres of habitat sooner. See table 11 for owl site priority.	that accelerate the development of multi-layered stands. Focus on single layered pole size stands in moist grand fir and wet forest groups.	
	6) Obtain information on spotted owl locations.	6) Survey areas to 1994 spotted owl protocol. See monitor list in individual owl section above.	B
	7) Achieve suitable habitat target acres by retaining suitable habitat on private land. (See table 11 for priority owl sites.)	7) Acquire private lands or coordinate management of private land habitat within owl site.	C
Aquatic	1) See goals listed in Aquatic section for Manastash LSR.	1) Coordinate projects with the Taneum/Manastash, and Little Naches, Watershed Assessments.	A
Noxious Weed	1) Limit the extent and spread of *Centauria diffusa* and *Chrysanthemum leucanthemum* in the LSR.	1) Consider treatments such as hand pulling and herbicides to limit extent and spread. Focus should be in high recreation use areas, particularly where stock are used.	A
	2) Control or eradicate *Cytisus scoparius, Cynoglossum officinale* and *Cirsium canadensis* where they occur within the LSR.	2) Use combination of treatments such as hand pulling, and spot herbicide application to eliminate these populations.	A
	3) Increase knowledge regarding noxious weed presence within the Taneum/Manastash drainage of the LSR.	3) Survey this portion of the LSR for presence of noxious weeds.	C
Fire Plan	1) Protect late successional values from loss due to wildfire	1) See fire plan for specific actions	

[1] Implementation Schedule; (A) = within 1 year; (B) = within 3 years; (C) = within 5 years (implementation is dependant upon availability of funding)

Attachment A
Dispersal and Suitable Spotted Owl Habitat Within 1.8 Mile Circles by Ownership

Manastash Late Successional Reserve

Dispersal and Suitable Spotted Owl Habitat Within 1.8 mile Circles by Ownership

	Dispersal Habitat			Suitable Spotted Owl Habitat							
				Dry			*Mesic*	*Wet*			*Total*
Owl #	FS	Not FS	Total	FS	Not FS	Total	Not FS	FS	Not FS	Total	*Suitable*
SO305	1,717	910	2,628	35	50	85	0	2,738	789	3,527	3,613
SO311	2,246	292	2,538	793	112	905	0	1,474	566	2,039	2,945
SO321	1,062	686	1,748	0	0	0	0	2,864	946	3,810	3,810
SO326	2,555	144	2,699	776	50	825	0	1,888	112	2,000	2,825
SO327	155	100	256	0	0	0	0	2,422	2,896	5,318	5,318
SO332	246	49	296	0	0	0	0	2,623	2,122	4,745	4,745
SO338	102	106	208	0	0	0	0	868	2,851	3,719	3,719
SO343	210	209	419	0	0	0	0	2,311	2,174	4,484	4,484
SO349	1,656	1,067	2,723	38	79	117	0	2,384	1,114	3,498	3,615
SO351	1,568	329	1,897	313	143	456	0	2,018	643	2,662	3,118
SO353	1,805	163	1,968	574	12	587	14	1,094	99	1,194	1,795
SO357	638	686	1,324	0	0	0	0	2,245	2,043	4,288	4,288
SO358	386	260	646	0	0	0	0	1,941	2,142	4,083	4,083
SO362	258	86	344	0	0	0	0	2,374	1,660	4,033	4,033
SO364	330	305	635	0	0	0	223	1,599	1,961	3,560	3,783
SO365	878	952	1,829	87	135	222	0	1,957	1,802	3,758	3,981
SO368	1,871	929	2,799	385	250	635	0	1,464	1,015	2,478	3,113
SO375	2	212	215	0	0	0	0	1,121	3,464	4,585	4,585
SO378	1,862	386	2,248	303	151	455	0	2,434	688	3,122	3,577
SO379	2,056	284	2,340	419	147	566	0	2,349	386	2,735	3,301
SO392	74	213	288	0	0	0	0	2,300	2,439	4,740	4,740
SO804	0	0	0	0	0	0	0	5,370	0	5,370	5,370
SO808	13	0	13	0	0	0	0	5,142	0	5,142	5,142
SO810	52	0	52	8	0	8	0	4,708	0	4,708	4,717
SO811	0	0	0	0	0	0	0	4,097	1,417	5,514	5,514
SO818	0	0	0	0	0	0	0	2,672	2,759	5,431	5,431
SO826	0	0	0	0	0	0	0	1,967	1,595	3,563	3,563
SO829	0	0	0	0	0	0	0	5,039	323	5,362	5,362
SO830	0	0	0	0	0	0	0	4,985	0	4,985	4,985
SO839	0	0	0	0	0	0	0	4,558	732	5,290	5,290
SO845	108	108	216	0	0	0	0	3,032	2,560	5,592	5,592
SO885	60	40	99	0	0	0	0	4,792	661	5,453	5,453
SO894	50	53	104	0	0	0	0	3,979	1,306	5,284	5,284

Manastash Late Successional Reserve

Dispersal and Suitable Spotted Owl Habitat Within 0.7 mile Circles by Ownership

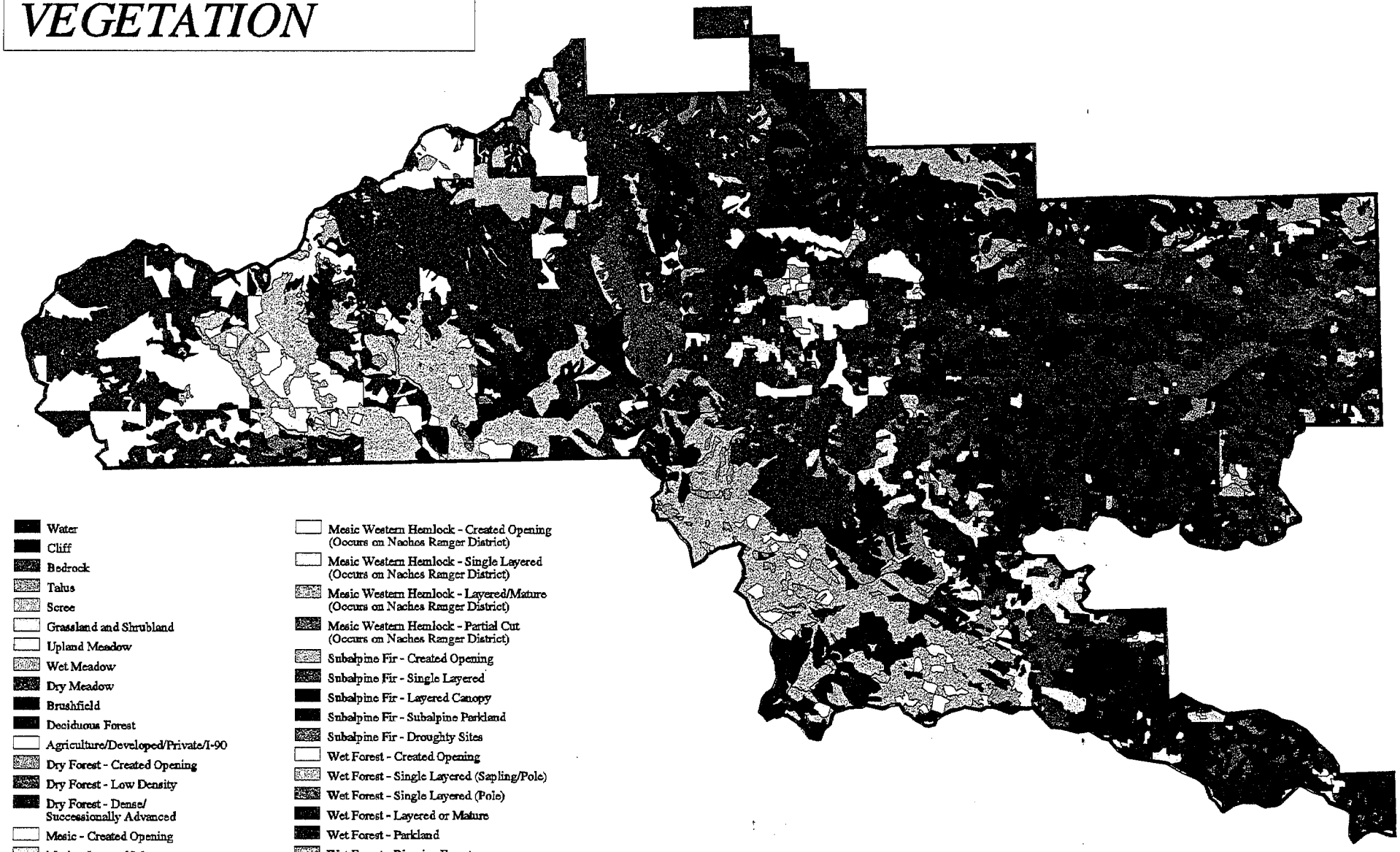
	Dispersal Habitat			Suitable Spotted Owl Habitat							
				Dry			*Mesic*	*Wet*			*Total*
Owl #	FS	Not FS	Total	FS	Not FS	Total	Not FS	FS	Not FS	Total	*Suitable*
SO305	209	248	457	0	0	0	0	320	208	528	528
SO311	359	0	359	208	0	208	0	240	0	240	448
SO321	297	1	298	0	0	0	0	665	6	671	671
SO326	454	25	480	75	1	76	0	385	2	387	463
SO327	0	0	0	0	0	0	0	453	377	831	831
SO332	0	0	0	0	0	0	0	520	250	770	770
SO338	11	2	13	0	0	0	0	288	324	612	612
SO343	0	16	16	0	0	0	0	578	169	748	748
SO349	126	425	551	0	0	0	0	172	230	402	402
SO351	76	104	180	77	97	174	0	141	237	378	552
SO353	456	37	493	147	3	149	0	108	0	108	258
SO357	57	151	208	0	0	0	0	411	360	772	772
SO358	74	5	80	0	0	0	0	363	342	705	705
SO362	0	0	0	0	0	0	0	361	133	493	493
SO364	0	0	0	0	0	0	3	221	271	492	495
SO365	211	142	353	3	45	49	0	266	112	378	427
SO368	205	131	336	65	47	112	0	207	268	475	587
SO375	0	0	0	0	0	0	0	70	635	705	705
SO378	244	5	248	93	0	93	0	450	7	457	550
SO379	344	71	415	82	0	82	0	305	25	330	412
SO392	1	29	30	0	0	0	0	693	184	876	876
SO804	0	0	0	0	0	0	0	855	0	855	855
SO808	0	0	0	0	0	0	0	786	0	786	786
SO810	0	0	0	0	0	0	0	745	0	745	745
SO811	0	0	0	0	0	0	0	858	47	905	905
SO818	0	0	0	0	0	0	0	363	526	888	888
SO826	0	0	0	0	0	0	0	238	368	606	606
SO829	0	0	0	0	0	0	0	859	0	859	859
SO830	0	0	0	0	0	0	0	792	0	792	792
SO839	0	0	0	0	0	0	0	812	1	813	813
SO845	0	0	0	0	0	0	0	365	610	975	975
SO885	0	0	0	0	0	0	0	904	8	912	912
SO894	0	0	0	0	0	0	0	523	273	796	796

5/7/96

Manastash Ridge
Late Successional Reserve
VEGETATION

Map Scale: 1 inch = 0.403 miles

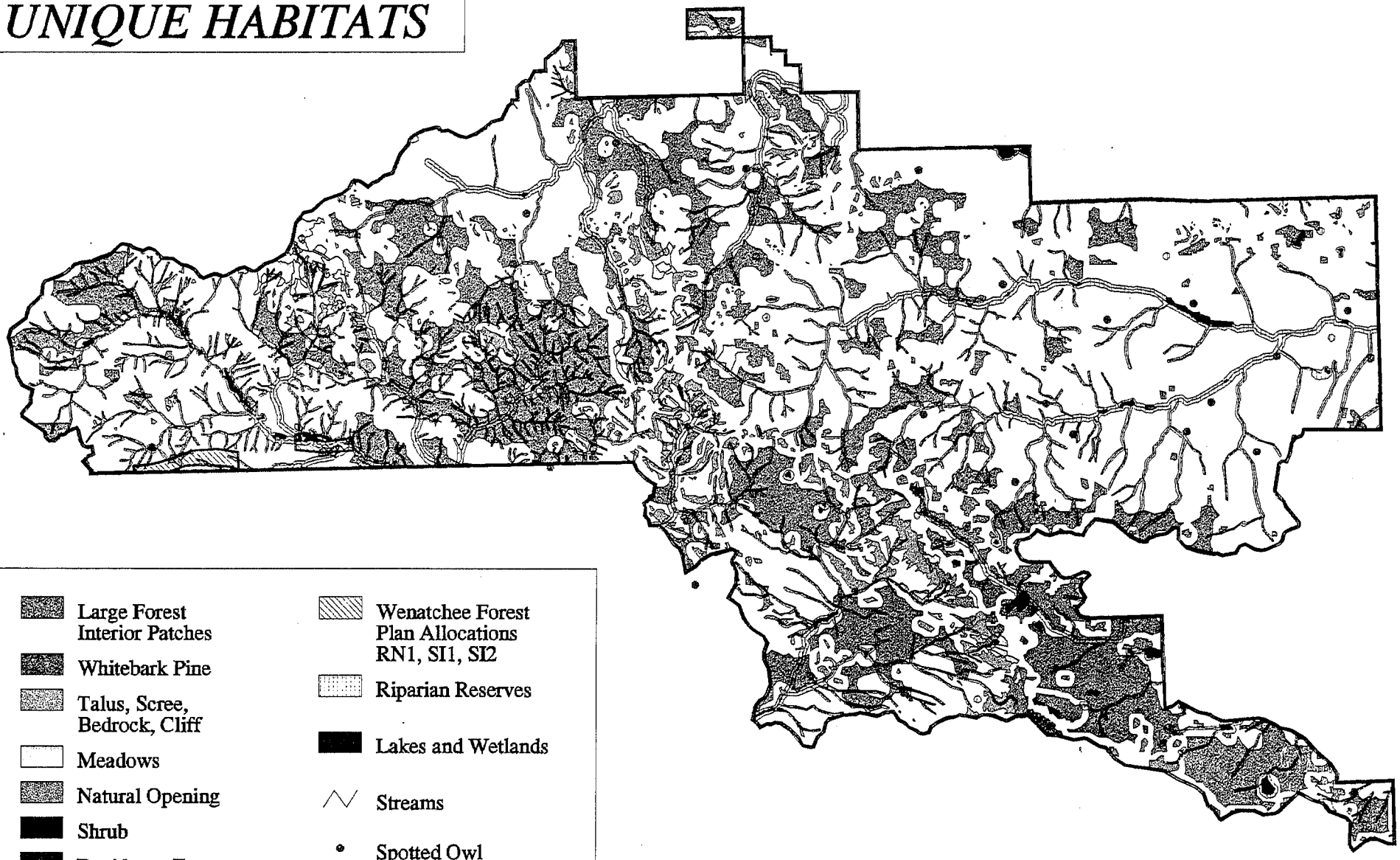
05/16/96



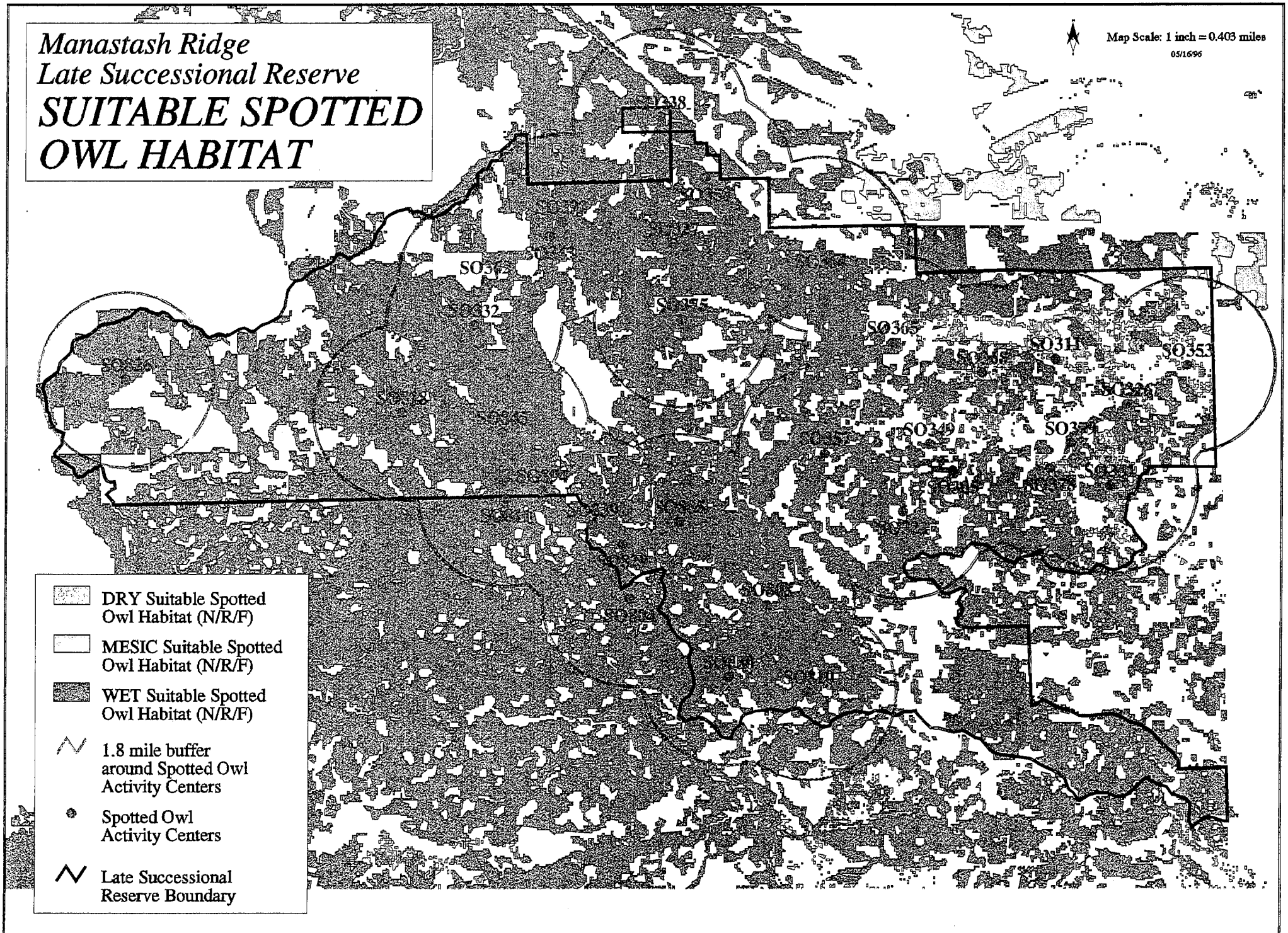
- Water
- Cliff
- Bedrock
- Talus
- Scree
- Grassland and Shrubland
- Upland Meadow
- Wet Meadow
- Dry Meadow
- Brushfield
- Deciduous Forest
- Agriculture/Developed/Private/I-90
- Dry Forest - Created Opening
- Dry Forest - Low Density
- Dry Forest - Dense/ Successionally Advanced
- Mesic - Created Opening
- Mesic - Layered/Mature
- Moist Grand Fir - Created Opening
- Moist Grand Fir - Single Layered
- Moist Grand Fir - Layered/Mature
- Moist Grand Fir - Partial Cut
- Mesic Western Hemlock - Created Opening (Occurs on Naches Ranger District)
- Mesic Western Hemlock - Single Layered (Occurs on Naches Ranger District)
- Mesic Western Hemlock - Layered/Mature (Occurs on Naches Ranger District)
- Mesic Western Hemlock - Partial Cut (Occurs on Naches Ranger District)
- Subalpine Fir - Created Opening
- Subalpine Fir - Single Layered
- Subalpine Fir - Layered Canopy
- Subalpine Fir - Subalpine Parkland
- Subalpine Fir - Droughty Sites
- Wet Forest - Created Opening
- Wet Forest - Single Layered (Sapling/Pole)
- Wet Forest - Single Layered (Pole)
- Wet Forest - Layered or Mature
- Wet Forest - Parkland
- Wet Forest - Riparian Forest
- Wet Forest - Open Dry Forest (Droughty Site)
- Wet Forest - Open Dry Forest (Droughty Site) (Avalanche Origin)
- Whitebark Pine/Subalpine Larch - Created Opening
- Whitebark Pine/Subalpine Larch - Not a Created Opening

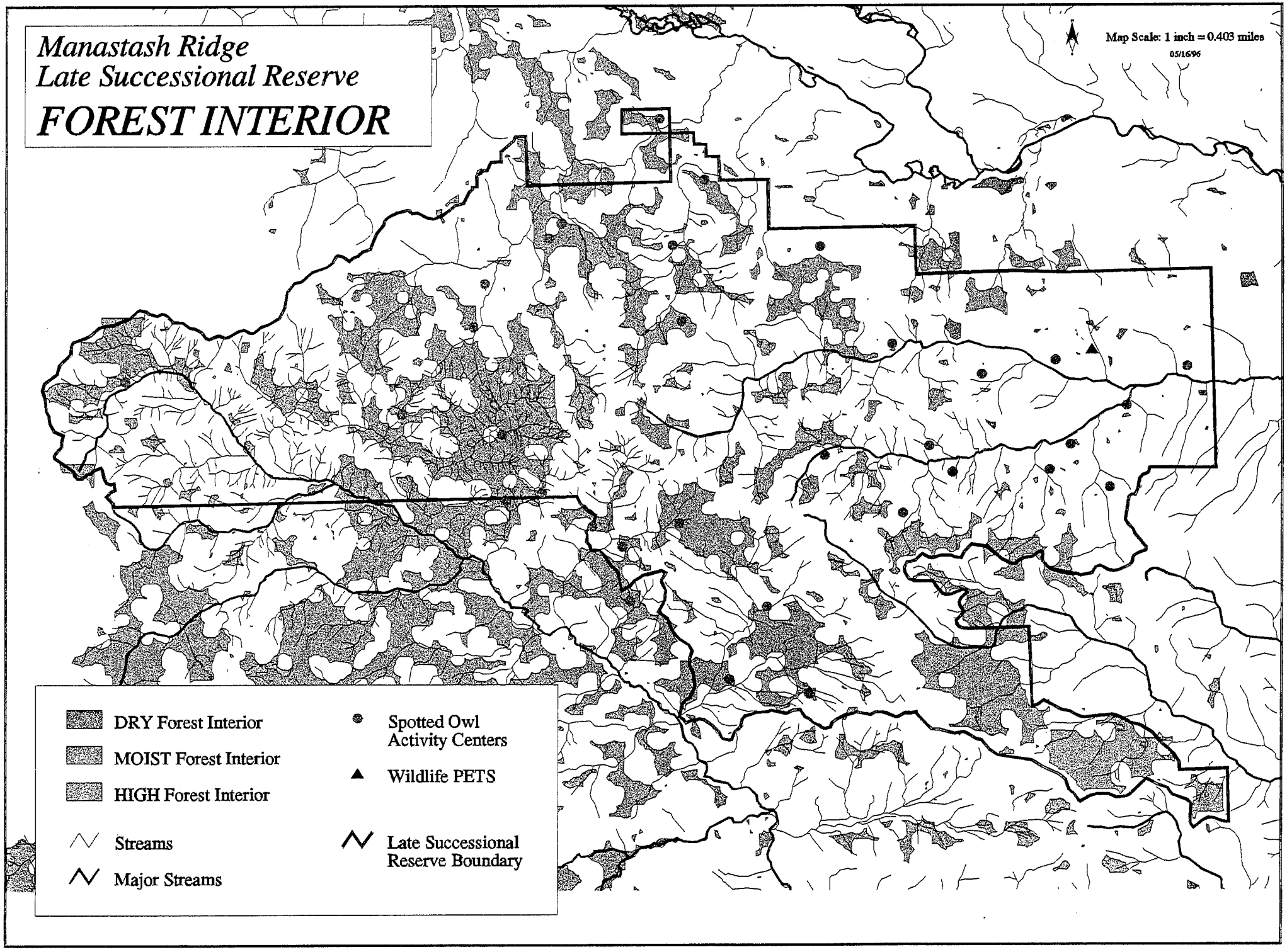
Manastash Ridge
Late Successional Reserve
UNIQUE HABITATS

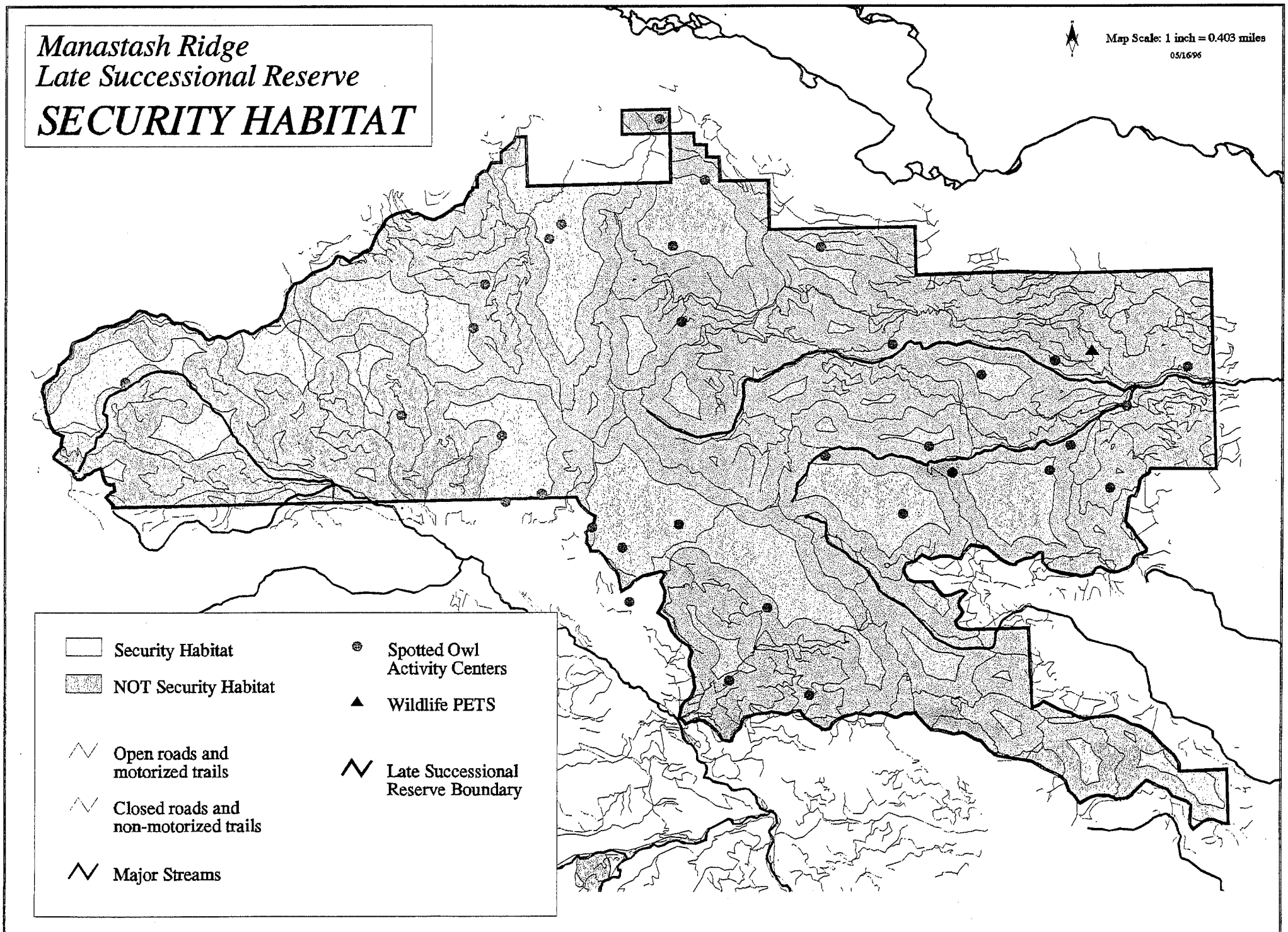
Map Scale: 1 inch = 0.403 miles
05/16/96

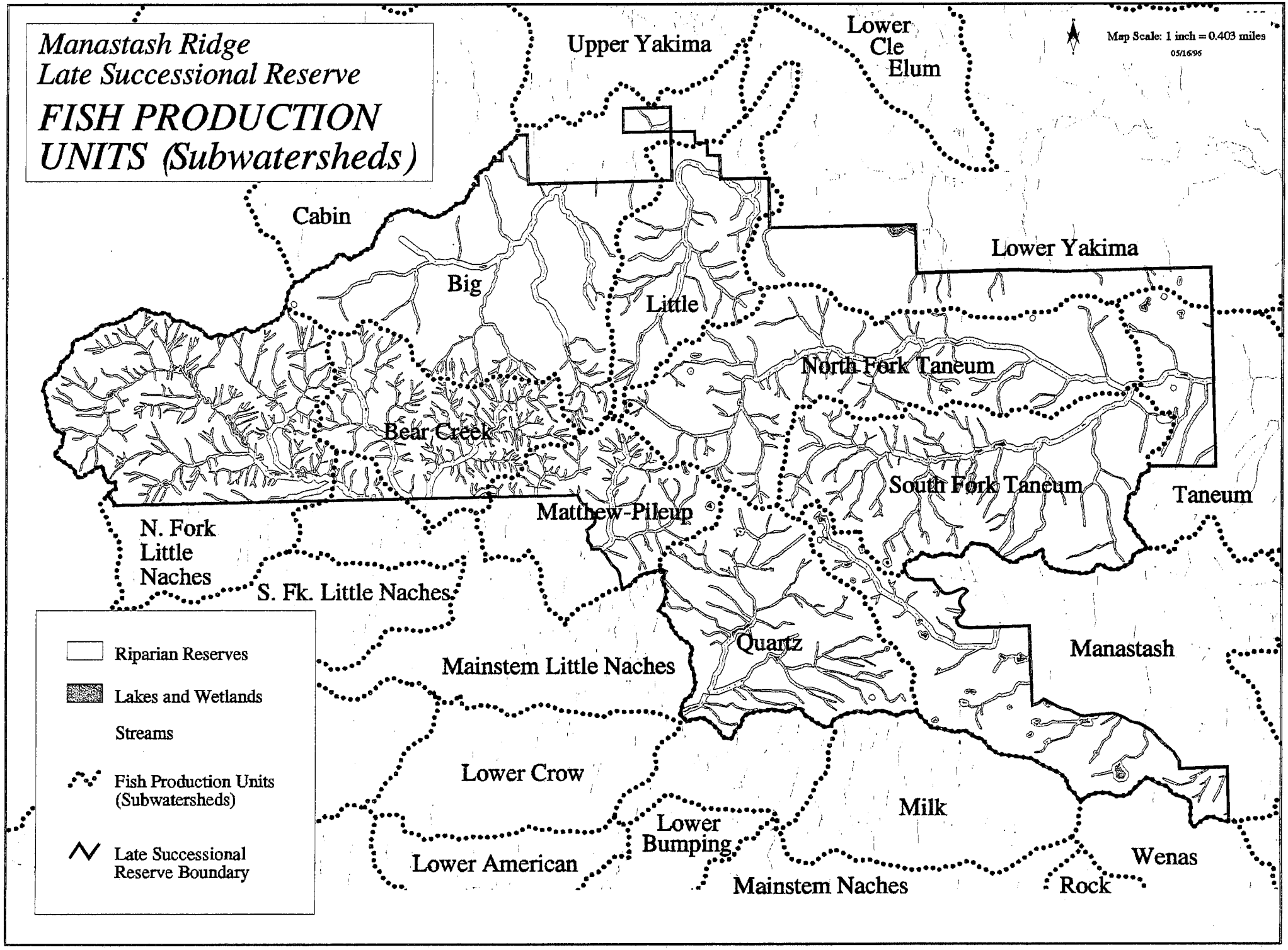


- Large Forest Interior Patches
- Whitebark Pine
- Talus, Scree, Bedrock, Cliff
- Meadows
- Natural Opening
- Shrub
- Deciduous Forest
- Late Successional Reserve Boundary
- Wenatchee Forest Plan Allocations RN1, SI1, SI2
- Riparian Reserves
- Lakes and Wetlands
- Streams
- Spotted Owl Activity Centers
- Wildlife PETS


Manastash Ridge
Late Successional Reserve
SUITABLE SPOTTED OWL HABITAT
Map Scale: 1 inch = 0.403 miles
05/16/96
DRY Suitable Spotted Owl Habitat (N/R/F)
MESIC Suitable Spotted Owl Habitat (N/R/F)
WET Suitable Spotted Owl Habitat (N/R/F)
1.8 mile buffer around Spotted Owl Activity Centers
Spotted Owl Activity Centers
Late Successional Reserve Boundary


Manastash Ridge
Late Successional Reserve
FOREST INTERIOR
Map Scale: 1 inch = 0.403 miles
05/16/96
DRY Forest Interior
MOIST Forest Interior
HIGH Forest Interior
Streams
Major Streams
Spotted Owl Activity Centers
Wildlife PETS
Late Successional Reserve Boundary


Manastash Ridge
Late Successional Reserve
SECURITY HABITAT
Map Scale: 1 inch = 0.403 miles
05/16/96
Security Habitat
NOT Security Habitat
Open roads and motorized trails
Closed roads and non-motorized trails
Major Streams
Spotted Owl Activity Centers
Wildlife PETS
Late Successional Reserve Boundary


Manastash Ridge
Late Successional Reserve
FISH PRODUCTION
UNITS (Subwatersheds)
Map Scale: 1 inch = 0.403 miles
05/16/96
Upper Yakima
Lower
Cle
Elum
Cabin
Big
Little
Lower Yakima
North Fork Taneum
Bear Creek
South Fork Taneum
Taneum
Matthew-Pileup
N. Fork
Little
Naches
S. Fk. Little Naches
Quartz
Manastash
Mainstem Little Naches
Lower Crow
Milk
Lower
Bumping
Lower American
Wenas
Mainstem Naches
Rock
Riparian Reserves
Lakes and Wetlands
Streams
Fish Production Units
(Subwatersheds)
Late Successional
Reserve Boundary